plating

JUNE • 1957

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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44th ANNUAL CONVENTION

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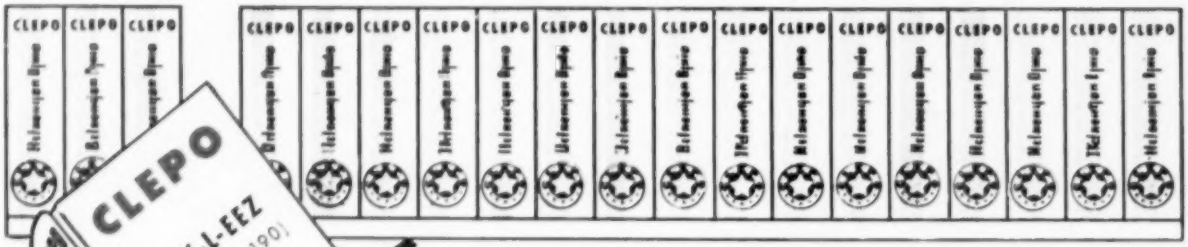

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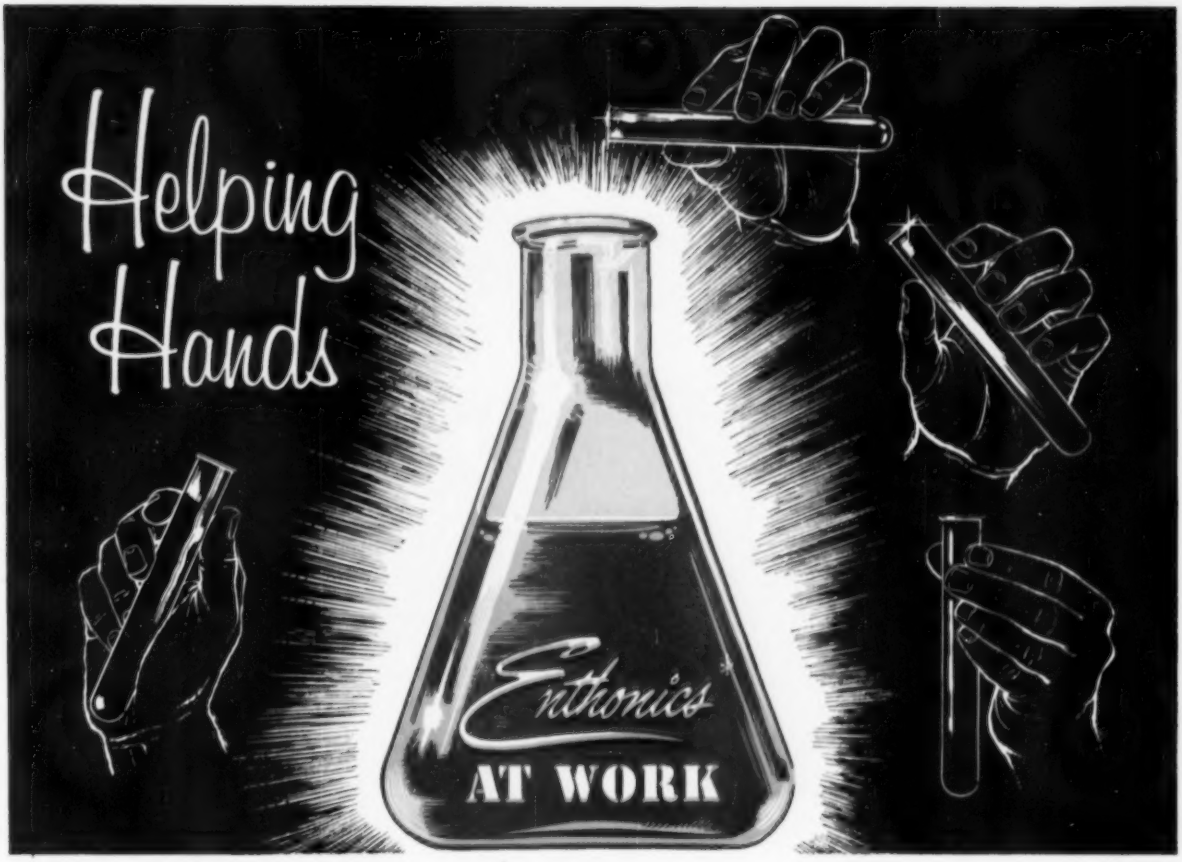

FROM THOUSANDS of TESTS . . .

. . . *come the solutions to your metal finishing problems.*

If *you* are looking for creative chemistry to supply new methods for the improvement of metal finishing, look to the leader – ENTHONE. Write for the answers to these problems, identifying them by number. If your specific problem is not listed, Enthone will gladly help to find the answer.

1. HOW TO BLACKEN copper, brass, zinc, steel and other metals to meet U.S. Government specifications.
2. HOW TO STRIP NICKEL from steel without etching the steel.
3. HOW TO STRIP NICKEL from copper and brass without attacking the part.
4. HOW TO SHED WATER from metals to prevent staining or spotting during drying.
5. HOW TO TRAP FUMES from hot sulfuric acid pickles.
6. HOW TO STRIP SYNTHETIC ENAMELS from aluminum and other metals without attacking the metal.
7. HOW TO CLEAN AND REMOVE RUST AND OXIDES from steel in one operation without acids.
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19. HOW TO COLOR ALUMINUM in one operation.
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Ruggedly built "LITTLE STEVE," the big hit of the Metal Finishing Industry, can be obtained at a surprisingly low initial cost. It is ideal for large or small companies for it will fit many production cycles. It uses an arm as a rack or will take racks for small parts.

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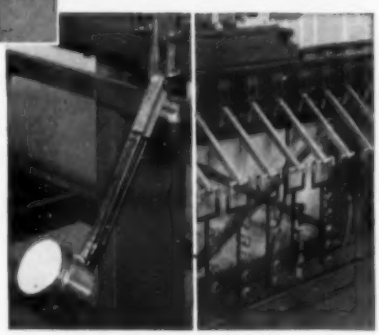
For further information about "LITTLE STEVE" write for illustrated folder or call your local Stevens sales engineer.



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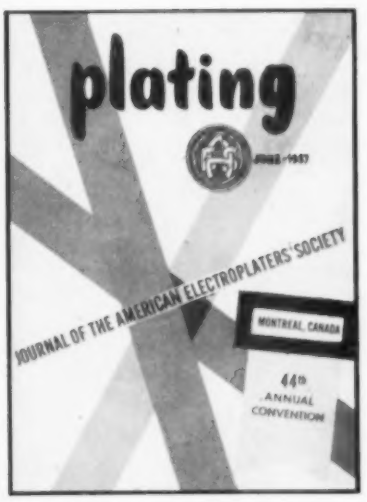

The special cover saluting the 44th Annual Convention as designed by James A. Civille.

plating

Journal of the American Electroplaters' Society

June 1957 **Vol. 44, No. 6**

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EDITORIAL

The Industry, the AES, and the Future

AS A National Officer for four years and previously a Branch Officer for five years, your president has traveled the length and breadth of this country and Canada, addressed many Branches and visited many plating shops and departments. These close contacts with the Society and industry have led to the following three conclusions:

First—the electroplating and metal finishing industry is an essential part of the process of manufacturing and fabricating of metal products and is of vital importance to the welfare and defense of the country. This industry has developed and expanded greatly in the last dozen years in order to keep pace with our industrial progress and with the new requirements of the aircraft, electronics, atomic energy and missiles fields.

Second—the AES, the technical society of the electroplating and metal finishing industry, has played an important role in the growth of this industry. This has been accomplished by the hard work and dedicated efforts of many members. Its progress during the past year is recorded in this issue of PLATING. This month, we meet in Convention at Montreal—the highlight of the year's activities. Today, the Society is a big society with over 7500 members, 56 branches and a total budget of over $200,000 a year. In 1956–1957, it also expended over $34,000 in research for the benefit of the members and industry as a whole and largely paid for by industry.

Third—the industry will continue to grow in volume and in new applications. The Society in turn must grow and influence future developments in the industry to an even greater extent.

How can this be accomplished? Plans are now being made.

The AES must look further to the education of those in the industry by fostering educational courses at all levels up to college training for researchers.

The AES must endeavor to make knowledge in the field more readily accessible. This can be done by constantly improving present publications and the issuance of new ones; by making more available the world's metal finishing literature and abstracts.

The AES must still further improve its meetings at the Branch and regional level and at the Annual Conventions and Industrial Finishing Expositions. These meetings are the most direct channel of communication among our members.

The AES must expand its research program. A sound theoretical basis for the electroplating process, for example, is still to be formulated; its solution would constitute a major breakthrough for further technical advancement.

The AES must, to a greater extent, sell the achievements of the industry and the Society to its members and to the public.

The AES must continue to expand its cooperation with other technical societies and groups for the good of the industry.

The AES must not live on its past good reputation. It must look and advance forward. It must achieve higher degrees of usefulness and service to the electroplating and metal finishing industry and to its members.

Samuel Heiman
President

TECHNICAL DATA ON IRIDITE® COATINGS

Process*	Applicable Metal	Color of Film	Purpose	Typical Applications	U. S. Govn. Specs.	Method of Application	Salt Spray Resistance
# 1 Olive Drab	Zinc and Cadmium	Olive Drab	Maximum corrosion protection, paint base, non-reflective finish	Nuts, bolts, die castings, hardware, Ordnance items, communication equipment, etc.	USA 57-0-2C MIL-F-14072 AN-P-32A QQ-Z-325 QQ-P-416 MIL-T-12879 AN-P-61 MIL-Z-17871 MIL-S-5002 AMS-2402D AMS-2400J USA-50-80-11A JDQ-No. 144B MIL-C-17711 MIL-P-17141 O. S. No. 1374	Immersion Single dip	100 to 400 hours to first white corrosion
# 2 Galvon	Hot dipped galvanized zinc	"	"	Gov. spec. work, paint base, etc.	MIL-T-12879 (QMC) MIL-Z-17871 (Navy)	"	"
# 3 Bronze	Zinc and Cadmium	Bronze	Maximum corrosion protection, bronze color	Wire goods, simulating brass, zinc die castings, etc.	Same specs as # 1 (Except where Olive Drab color is specified)	"	"
# 4P-C&S Bright	Cadmium	Chemical polished, clear and bleached clear	Clear finish, tarnish & corrosion resistance, good solderability	Plated electrical contacts, chassis, etc.	One dip may be used under some circumstances	Single dip or bleached clear	24 to 72 hours to white corrosion
# 4-2 # 4-2A # 4-2P Bright	Zinc	Chemical polished, iridescent yellow, bleached clear	Decorative, bright chrome-like surface, mild corrosion protection, good finger-print & tarnish resistance	Electronics, wire goods, hardware, etc.	One dip (No bleach will meet all spec requirements on Cad listed under # 1)	Single dip or bleached clear	24 to 96 hours to white corrosion
# 4-73 # 4-75 Cast-Zinc-Brite	Zamac 3 Zamac 5 Zinc die castings	"	Chrome-like appearance. Excellent corrosion protection and good base for plating	Brackets, carburetors, reconditioning stripped parts, etc.	(No bleach) One dip will meet the following Specs.- MIL-C-17711 MIL-T-12879 MIL-F-14072	"	Clear-48 to 200, yellow-100 to 300 hours to white corrosion
# 5 Spectron	Zinc plate and hot dipped galvanize	Iridescent yellow	Good corrosion resistant final finish	Hot dipped galvanize, Zinc Iron alloy wire and strip, etc.	Will meet all Zinc specs. listed under # 1	Single dip	100 to 200 hours to white corrosion
# 5P Chromate	Zinc and Cadmium	Iridescent yellow	Low cost powdered compound, good corrosion resistance	Any finish calling for iridescent yellow chromate	Will meet all specification requirements listed under # 1	Single dip	100 to 200 hours to white corrosion
# 8 HueBrite	Zinc and Cadmium, hot dipped galv., zinc die castings	Iridescent yellow, chemical polished, yellow bleached clear	Multi-purpose. Decorative, bright chrome-like appearance through yellow. Finger-print, tarnish & salt spray resist., paint base-zn.	Carburetors, shell casings, refrigerator shelves, etc.	Will meet all specification requirements listed under # 1	Single dip or bleached clear	Clear-24 to 96 hours, Yellow-100 to 200 hours to white corrosion

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Process*	Applicable Metal	Color of Film	Purpose	Typical Applications	U. S. Govn. Specs.	Method of Application	Salt Spray Resistance
# 8P BluBrite	Zinc and Cadmium, hot dipped galv., zinc die castings	Iridescent yellow, chemical polished, yellow bleached clear	Multi-purpose. Decorative, bright chrome-like appearance through yellow, fingerprint, tarnish & salt spray resist., paint base-zn.	Carburetors, shell casings, refrigerator shelves, etc.	One Dip (no bleach). Will meet all specification requirements listed under # 1	Single dip or bleached clear	Clear-24 to 96 hours, Yellow-100 to 200 hours to white corrosion
# 8-2 Economy Pak	"	"	"	"	"	"	"
# 8-4 Power Pak	Zinc and Cadmium, hot dipped galv., zinc die castings	Iridescent yellow, chemical polished, yellow bleached clear	Multi-purpose. Decorative, bright chrome-like appearance through yellow. Fingerprint, tarnish & salt spray resist. Paint base-zn.	Carburetors, shell casings, refrigerator shelves, etc.	Will meet all specification requirements listed under # 1	Single dip or bleached clear	Clear-24 to 96 hours, Yellow-100 to 200 hours to white corrosion
# 12 Brite-Zinc-Seal	Zinc Plate	Chemical polished, clear blue bright	Economical, one dip, clear blue bright	Bulk work, wire goods, etc.	NONE	Single dip	24 to 48 hours to white corrosion
# 12P Brite-Zinc-Seal	Zinc Plate	Chemical polished, clear blue bright	Economical, one dip, clear blue bright	Bulk work, wire goods, etc.	NONE	Single dip	24 to 48 hours to white corrosion
# 14 (Al-Coat)	Aluminum Alloys	Clear to yellow	Appearance, corrosion, paint base. Low electrical resistance, general bonding, replaces electrolytic anodizing except for abrasion resistance	Aircraft, electronics, hardware, storm windows, etc.	MIL-C-5541 AXS-1607	Immersion single dip, Spray, Brush-On	Depends on alloy
# 14-2 (Al-Coat)	"	Clear (bleached) yellow brown	" Highest possible corr. protection, extremely flexible in operation, conc., imm. time, and film thickness	"	MIL-C-5541 AXS-1607	"	"
# 14-9 Al-Coat Clear	Aluminum Alloys	Clear	Corr. protection with lack of color	To replace Chromodizing in aircraft, storm windows, etc.	MIL-C-5541 AXS-1607	Single dip	Depends on alloy
# 7 (Metcote)	Copper and alloys	Bright, brownish or bleached clear	Appearance, chemical polish, tarnish and corrosion resistance on lead free alloys	Wire goods, Base for Cu, Ni, Cr plate, etc.	NONE	Immersion Single dip or bleached	No standard
# 17-P (Cupreous Kote)	Copper and alloys Nickel Gold	A mix brownish B mix clear	High Corrosion resistance Tarnish resistance, good paint base, prevents spotting out on plate, good solderability.	Wire goods, hinges, hardware, electrical contacts, etc.	NONE	Immersion Single dip	"
# 15 (Mag-Coat)	Magnesium and alloys	Grey thru brown to brownish black	Corrosion protective paint base, low electrical resistance	Office equipment, Aerial cameras, etc.	NONE	Immersion Single dip	No standard. Comparable to Dow # 7
# 18-P Silver-Kote	Silver	Clear to yellow cast	Tarnish resistance, replace water dip lacquer	Commercial, Electrical, etc.	NONE	"	No standard

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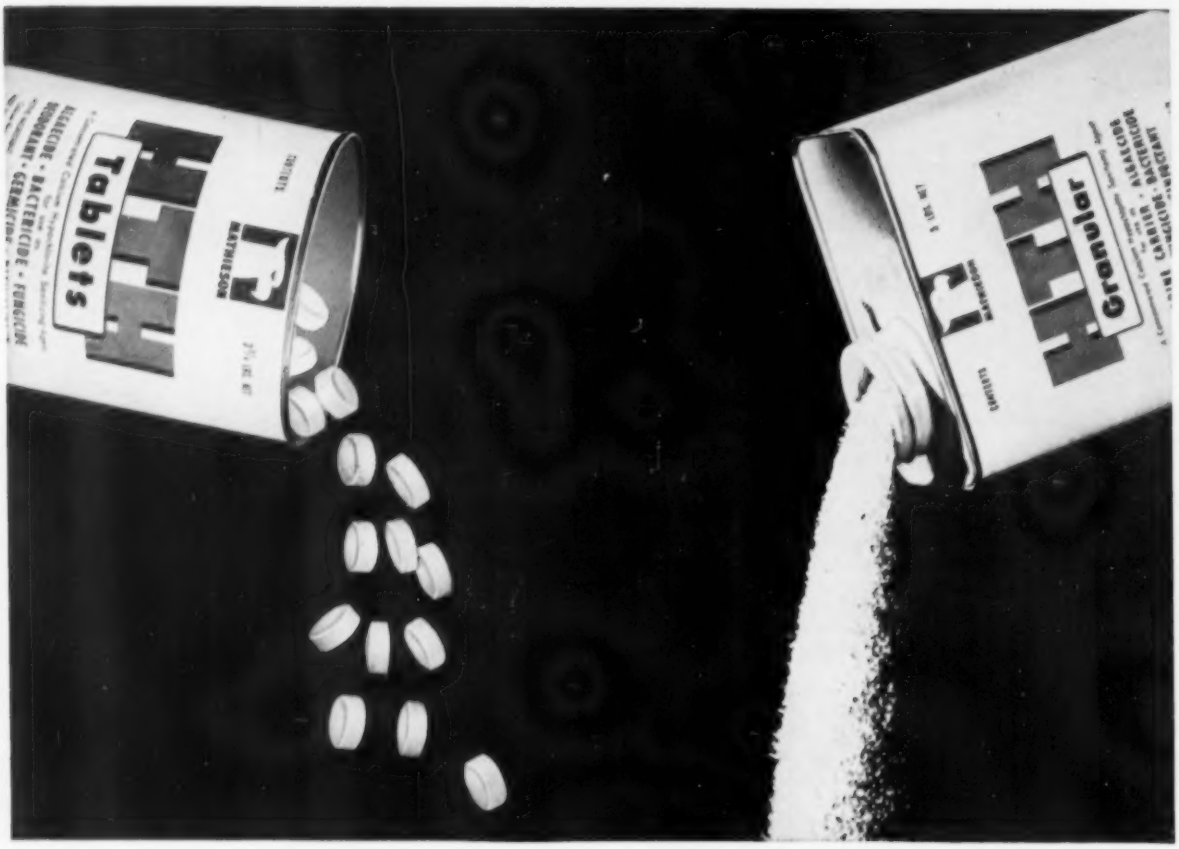

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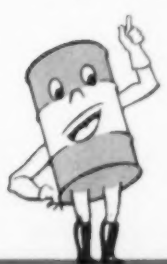

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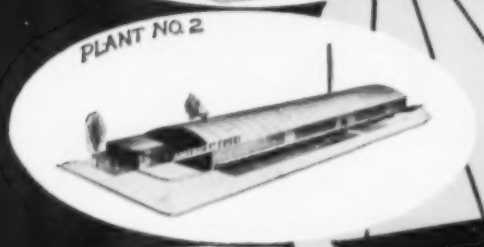

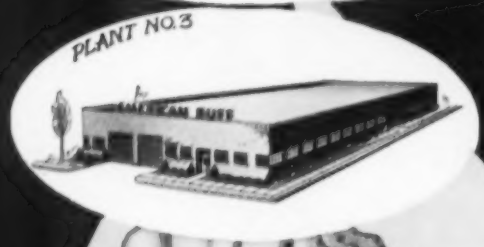

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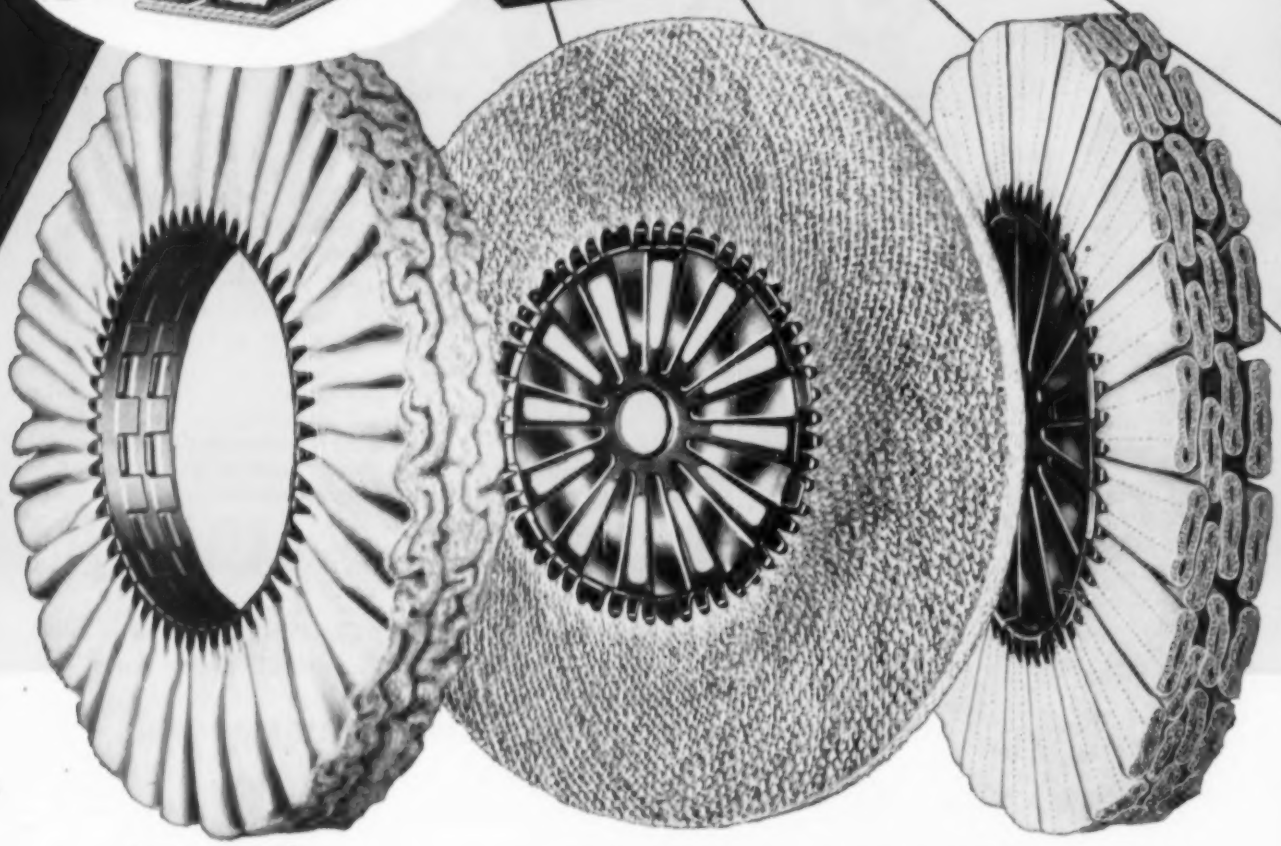

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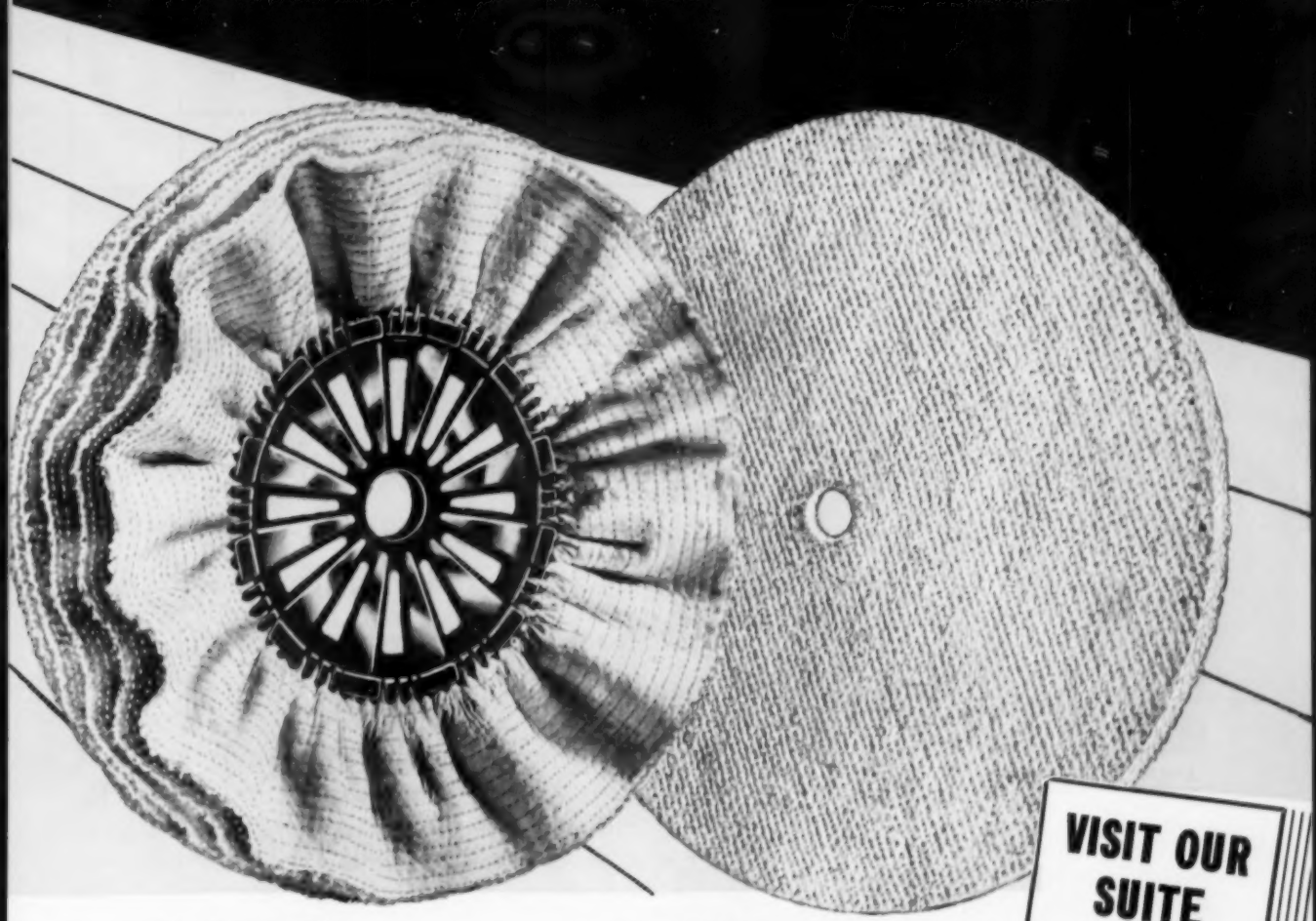

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PRODUCT	FEATURES	STEEL	BRASS	COPPER	ZINC DIE CASTINGS
C.S.R.*	Outstanding for removing carbon smut from steel and cast iron. Has excellent resistance to chrome contamination.	YES		YES	
F.S.*	The industry standard for heavy-duty, reverse-current electro-cleaning. High detergency and soil tolerance.	YES			
90	Heavy-duty, reverse-current electrocleaner. Combines good over-all detergency with excellent carbon and general smut removal. Has high resistance to chrome contamination.	YES		YES	
B.D.	Heavy-duty, reverse-current electrocleaner with extra-high conductivity. An economy product with extremely low use-cost.	YES			
B.N.	A versatile electrocleaner for steel, copper, brass, bronze, and zinc-base die castings. Also cleans and activates nickel before chrome.	YES	YES	YES	YES
LECTRITE NF	An inhibited electrocleaner for brass and zinc-base die castings in automatics or hand lines. Prevents etching, staining, and excessive oxidation during cleaning and long transfers.		YES		YES

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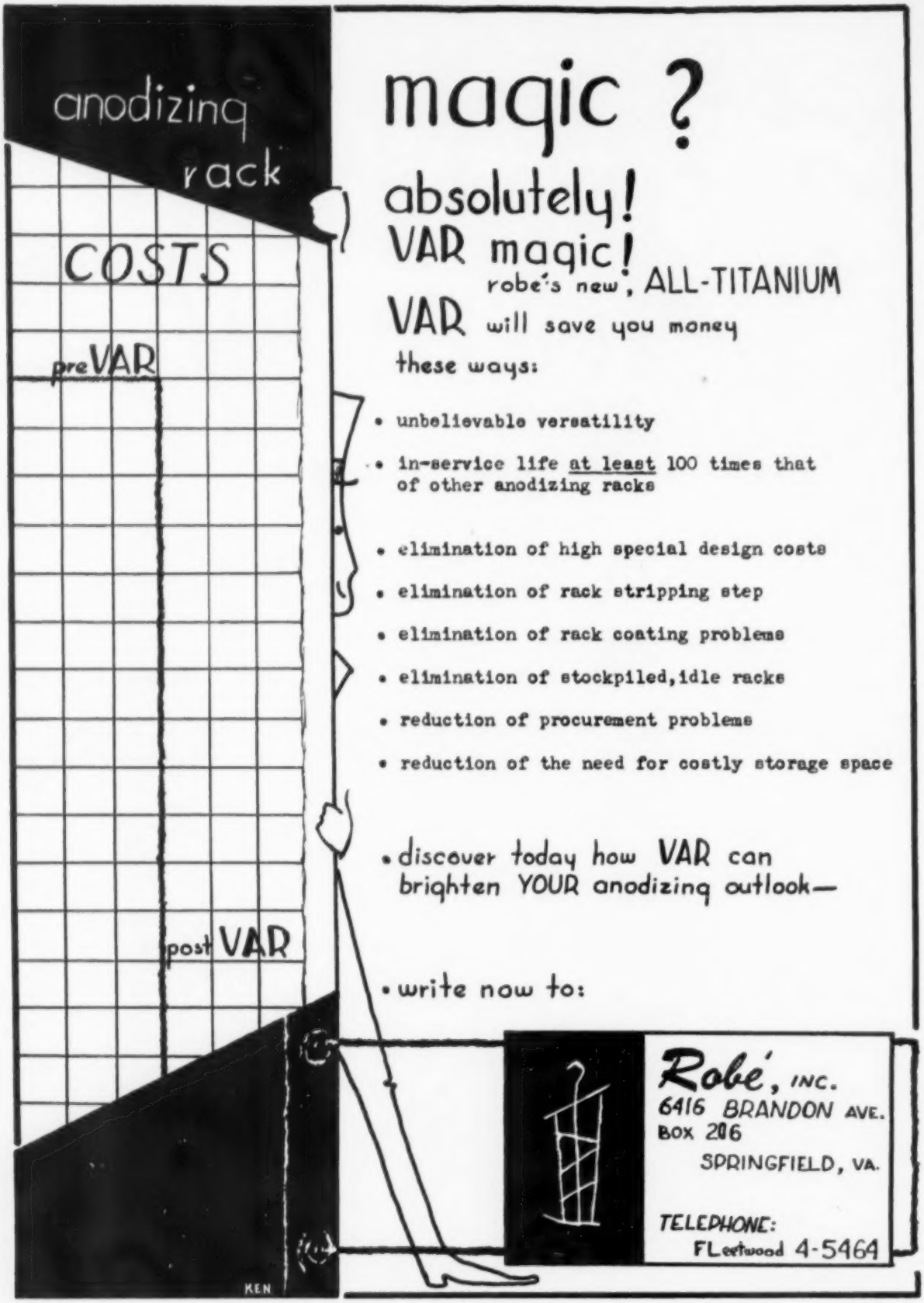

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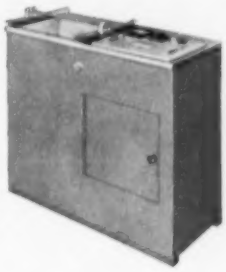

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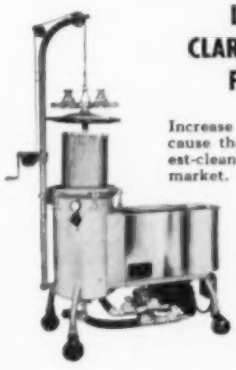

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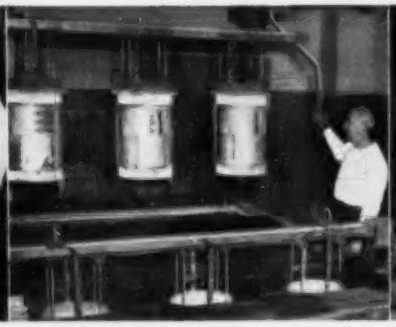

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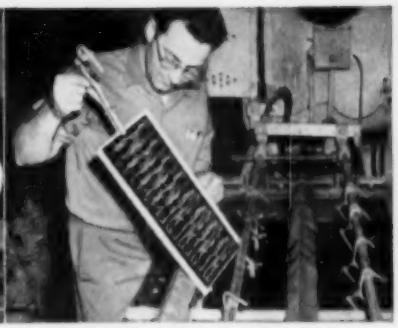

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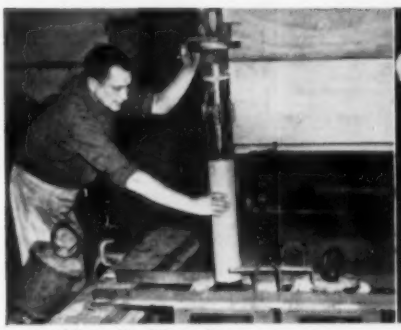

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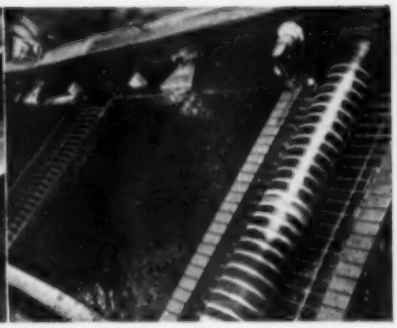

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Ideal for bumpers, bumper guards, grills and exterior auto parts

Harshaw Perflow-Perglow offers many advantages of special interest to manufacturers of bumpers, bumper guards, grills and exterior auto parts. This has been proven through five years of production experience. Ideally blending the outstanding qualities of Perflow with Perglow, it is the only nickel plating process which gives maximum qualities of brightness, leveling, ductility and corrosion resistance.

Fully Bright Deposits — The Perflow-Perglow plate is bright over a wide range of current densities from a few amperes/ft.^{2} to well over 100 amperes/ft.^{2}.

Excellent Ductility at Full Brightness—The Perflow-Perglow nickel plate is almost equal to the ductility of Watts nickel.

The corrosion resistance of the Perflow-Perglow nickel plate is unequalled by any other bright nickel process. In fact, its corrosion resistance is superior to that of buffed grey nickel.

High leveling characteristics which minimize or eliminate base metal imperfections—The Perflow-Perglow nickel plate has excellent leveling characteristics that aid in producing bright deposits on poorly polished steel or over dull copper plate. The leveling characteristics can be maintained without sacrificing ductility, brightness, and corrosion resistance.

Easily Chrome Plated—Normally a really bright nickel is rather hard to chrome plate. This is not true of Perflow-Perglow nickel. No unusual or special treatment of the nickel is required even over extended periods of time.

HARSHAW

HARSHAW PERFLOW
has unusual leveling properties

Perflow nickel plating has the unusual property of filling in scratch marks . . . in most cases to such a degree that it eliminates some costly steps in polishing the base metal prior to plating.

Extensive production experience has proved that as high as 70% of the cost of buffs and buffing compounds, and 50% of buffing labor costs are eliminated in the final nickel finishing, since the Perflow deposit is so easily color-buffed to a brilliant finish.

- Semi-brite Nickel Deposit
- Unequaled Corrosion Resistance
- Extremely ductile deposits
- Can utilize air agitation for higher plating speeds
- Two addition agents for simple control and maintenance
- Tried and proven process—ten years production experience in the largest plating installations.

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then decide on Harshaw Nickel Processes

PUT NEW BRIGHTNESS ON YOUR PRODUCT

Install Harshaw's Nubrite Bright Nickel Process

The NUBRITE NICKEL PROCESS produces an unusually bright lustrous and bright ductile nickel deposit.

Nubrite Brightness and Leveling—Nubrite nickel plate brightens quickly over a wide range of current densities from a few amperes/ft.^{2} to well over 100 amperes/ft.^{2}. Some users of Nubrite, who are plating "inside hardware", are able to get better brightness and lustre with thinner deposits than is possible with competitive solutions.

Excellent Corrosion Resistance—Equal to or better than deposits from other bright nickel solutions.

Nubrite Ductility—Nubrite has better ductility in the long run than less lustrous competitive bright nickel deposits. Nubrite has the distinct advantage of remaining ductile after long operation.

Nubrite Operates and Controls Easily—The recommended operating conditions for the Nubrite bright nickel bath are a pH of 3.2-4.0 and a temperature of from 130 to 140°F. In several instances, installations are being operated at temperatures as low as 120°F and as high as 155°F with continued excellent bright plate. The pH can also vary over a much wider range than recommended where special conditions in a shop may make it necessary.

Nubrite's High Tolerance To Impurities—The many operating Nubrite solutions remain bright and ductile over a longer period of time than competitive solutions in the same installations. One large plating installation using Nubrite on zinc base die castings has been operating for seven months without continuous electrolytic purification or other treatment.

Chrome Plating—Nubrite is exceptionally receptive to chrome plating and enhances consistently good coverage even after extended time delays between nickel and chrome. It easily accepts coatings of other metals such as brass, silver and gold.

Ease of Conversion—The majority of bright nickel baths on the market today can be easily converted to the Nubrite bath.

NIBRITE BARREL NICKEL PLATING PROCESS

for really bright barrel nickel plating

Harshaw Nibrite Barrel Nickel meets the need of the plating industry for a barrel nickel solution which will continuously give plated surfaces with brightness equal to that obtained from nickel still tanks. Parts plated in the Nibrite solution may be chrome plated. The solution is easily controlled. Harshaw Nibrite Barrel Nickel solution can be used in any conventional barrel plating equipment.

- Fast brightening rate
- Good ductility and adhesion
- May be operated hot or cold
- Fast deposition rates through use of higher solution temperatures
- Two liquid addition agents for simplified control—only one addition agent added frequently.

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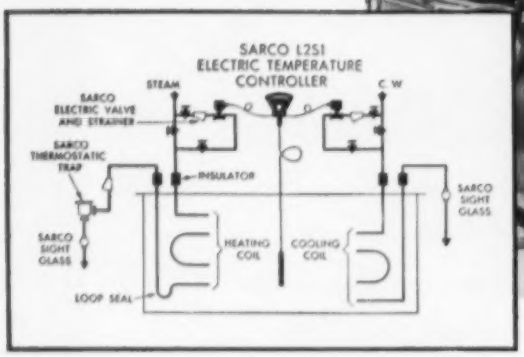
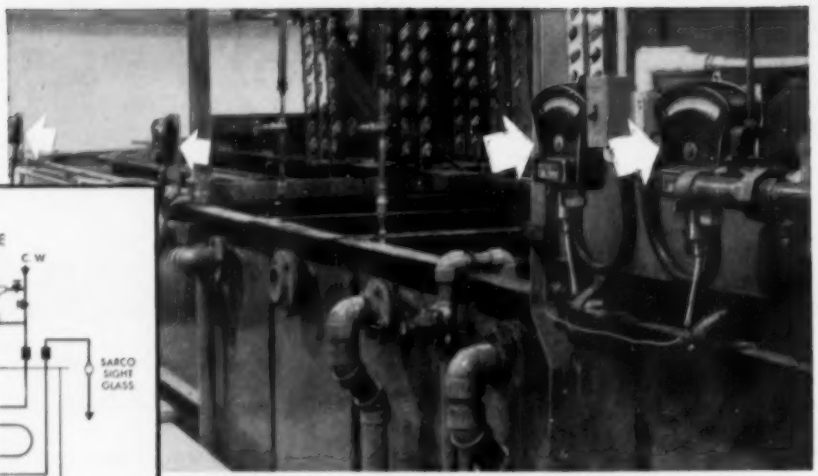




Seventeen Sarco Electric Temperature Controllers help maintain high quality plating—cut costs—at Ronson Corporation, Delaware Water Gap, Pa. Controllers are used on chrome, nickel, copper, silver, and gold plating tanks. This is a repeat installation.

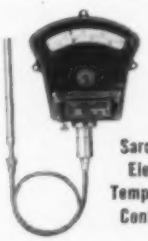
Improve plating quality—cut your costs with low-cost temperature control

Unstable bath temperatures . . . the result of erratic manual temperature control . . . are sure to lead to costly rejects, wasted man-hours and breakdown of plating solutions.

You can solve these problems at *low cost* . . . by installing always-reliable Sarco Automatic Temperature Control. Just think . . . a complete Sarco System is yours for as little as $130 a tank!

1. **You improve plating quality** because creeping temperatures are a thing of the past.
2. **You lower rejects** because solutions are held automatically to pre-set temperatures. No chance for human error to mess up a tankload . . . and cut into profits.
3. **You get better utilization of time** —platers are able to concentrate on their plating work. No worrying about bath temperatures. No turning on and off of valves.
4. **You save plating solutions** — because automatic control prevents boil-off caused by overshooting temperature.

Write for Bulletin 1025-B or consult your plating supplies jobber. Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.



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A COMPLETE SYSTEM FOR AS LITTLE AS $130 A TANK!

Think of it . . . automatic temperature control that often pays for itself in weeks!

Easy-to-read controller dial clearly indicates temperature being maintained. Temperature setting quickly changed by turning one knob.

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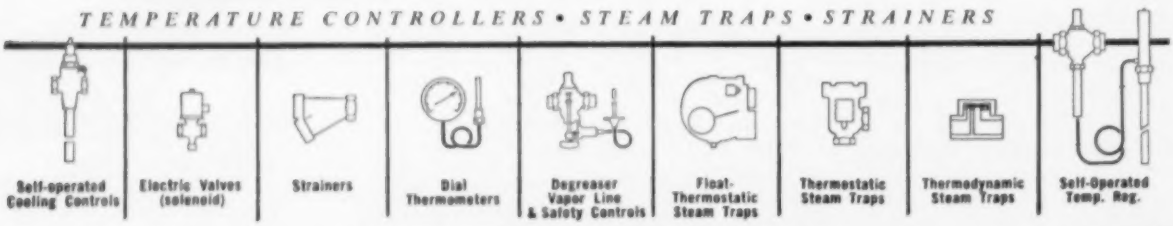

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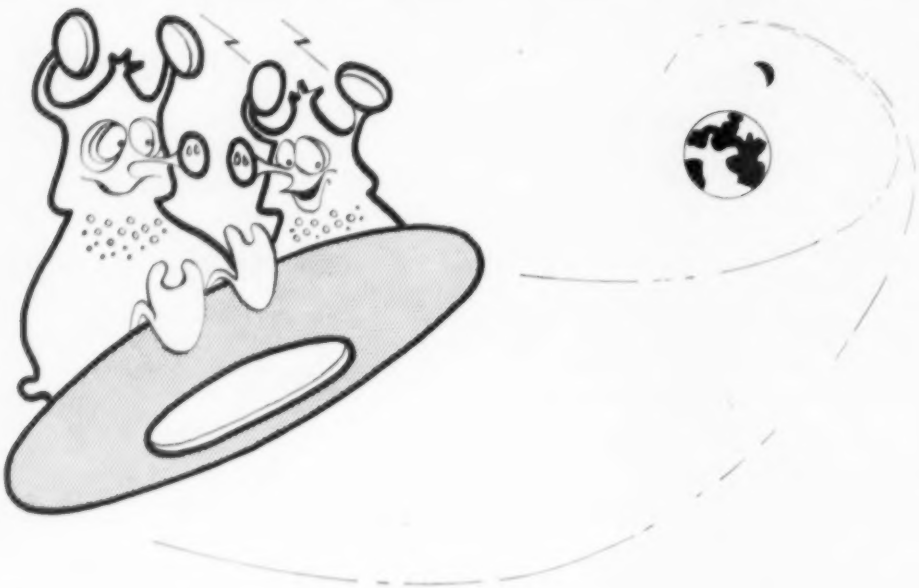

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★ LUCITE MODEL "WT" 1000ml. HULL CELL—with quartz heater and built-in thermostatic control. The "WT" Hull Cells are convenient for making uniform, repeat plating tests at bath operating temperatures. The "WT" 1000ml. Hull Cell is preferred for bright nickel.

★ LUCITE "WT" DUPLICELL—with quartz heater and built-in thermostatic control. For making duplicate bright nickel deposits preparatory to testing chromium baths for optimum catalyst ratio. (Plain Duplicell, without heater and thermostat, is also available.)

★ NEW MODEL HANGING HULL CELL—catches plating troubles at the source by spot checks. Just suspend the cell on the cathode busbar (as you hang a rack of work). Adaptable to any type of still or automatic plating.

★ LUCITE 267ml. HULL CELL—for all plating baths except chrome.

★ LUCITE 1000ml. HULL CELL—for all plating baths except chrome, preferred for bright nickel.

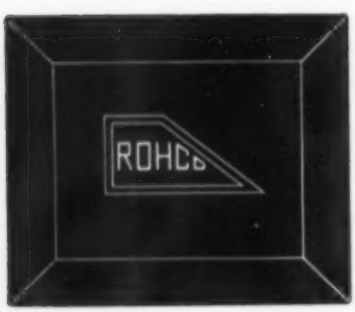
★ SOLID-WALL PORCELAIN 267ml. HULL CELL—for general use, especially chromium. The ONLY cell that can be placed directly on a hot plate.

★ MOLDED POLYTHENE 267ml. HULL CELL—for all baths up to 180° F.

★ LUCITE MODEL "WT" 267ml. HULL CELL—with quartz heater and built-in thermostatic control; for all plating baths except chrome.

★ MODEL C-3 CURRENTESTER—affords the ONLY SURE way of detecting and correcting hidden rectifier defects that may decrease electrical efficiency, slow down production, or give poor quality plating.

★ MODEL B1000-1-1 HULL CELL RECTIFIER—has unusual refinements, accuracy and simplicity of operation for laboratory or bench plating. Output: 30 amps. D.C., at 13 volts for general use, or 6 amps. D.C.,



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accomplishing . . . with ROHCO® PRODUCTS?"

at 18 volts for Hull Cell use. Full wave rectification with output filtered to give 3% ripple; powerstat voltage control from zero to full voltage; dual ammeter; voltmeter.

★ OTHER RECTIFIERS—for Hull Cell tests and/or plating operations. Complete range of capacities from 5% or less ripple. Optional automatic timers for 5 to 50 ampere units.

★ THREE SPEED HULL CELL AGITATOR—simulates cathode rod agitation in the Hull Cell by means of reciprocating motion of its paddle.

★ SAMPLING TUBE—unbreakable lucite. Designed for perfect sampling of plating baths without mess or fuss.

FOR ZINC PLATING

★ ROHCO 503 STILL OR BARREL ZINC BRIGHTENER (LIQUID)—produces jewel-like bright zinc deposits; ideal where one brightener is desired for all your bright zinc baths.

★ ROHCO 100 AND 100 SPECIAL BARREL BRIGHTENERS (LIQUID OR POWDER)—the most widely used of all barrel zinc brighteners; brilliant, bluish deposits directly from the plating tank.

★ ROHCO 200 BARREL BRIGHTENER (LIQUID)—the newest addition to the ROHCO series; somewhat less brilliant deposits than with ROHCO 100 but at lower cost.

★ ROHCO 150 (POWDER) AND PERMA-BRITE B-150 (LIQUID) BARREL BRIGHTENERS—the most economical barrel brighteners on the market; for maximum brightness a bright dip is required.

★ PERMA-BRITE S-400 STILL BRIGHTENER (LIQUID)—somewhat less brightness than with ROHCO 503, at lower cost.

★ ROHCO 120 STILL BRIGHTENER (LIQUID)—the most economical still brightener on the market; for large volume, large scale plating where maximum brightness is not necessary, generally requires a nitric acid bright dip.

★ ROHCO ZINC PURIFIER—to keep baths in tip-top shape for unfailing quality and appearance.

FOR CADMIUM PLATING

★ ROHCO 20XL AND SUPER XL (LIQUID OR POWDER)—tops for producing the clearest, brightest barrel, or still cadmium; minimizes cadmium usage by improving uniformity and speed of deposit.

★ RODIP CD-3 AND CD-4—single short-dip chromate post-plating treatment without leach for brilliant cadmium with good corrosion protection; CD-3 for automatic tank or barrel, CD-4, for manual operations.

★ CAD-SOL—a heavy solution of cadmium cyanide for easiest bath makeup or maintenance.

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★ ROHCO SUPER NO-CRO-MIST®—safeguards workers' health by eliminating chrome fumes, solves ventilating and heating problems, saves chromic acid.

★ BLANKETTES—Polyethylene triangles that float on top of bath to inhibit chromic acid mist.

★ HULL CELLS AND RECTIFIERS—for speedy, positive catalyst control.

★ ROHCO RINS-AID®—water-shedder additions to rinse cycle to improve drying and to prevent staining.

FOR ALUMINUM ANODIZING

★ ANODICATOR THICKNESS TESTER—automatically determines thickness of anodic coatings on aluminum as specified in ASTM B110-45. Essential for every aluminum anodizing plant.

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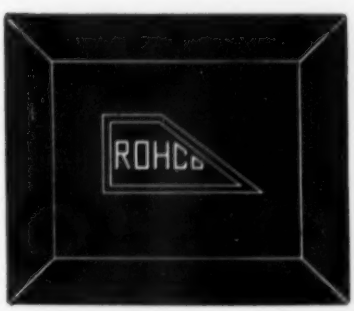


BRC FILM GAUGE

TYPE 255-A

Price: $450.00 F.O.B. Boonton, N. J.

MEASURES
FILM THICKNESS OF

non-magnetic films on
non-magnetic basis metals

SUCH AS:

Silver on Brass
Cadmium on Copper
Silver on 18% Nickel Silver

AND:

Anodic Films on Aluminum
(anodized aluminum)

Organic Paints, Porcelain, Enamel, and other non-conductive coatings on Aluminum, Magnesium, etc.

SORTS
METALS

in accordance with their electrical conductivity

MATCHES
METALS

in accordance with their magnetic properties

The Film Gauge, Type 255-A, measures the plating thickness of most non-magnetic metal combinations in addition to those listed. Fig. 1 shows a typical gauge standard for this type of measurement. The Film Gauge also measures non-conductive coatings such as anodic film on aluminum, magnesium, etc. Fig. 2 shows a gauge standard for this type of measurement. Gauge standards are available as accessories at extra cost.

For sorting or matching metals by their electrical or magnetic properties, no gauge standard is required. Simply select a sample exhibiting the desired characteristics — establish an arbitrary meter reading — sort and/or match by deviations on the meter.

GAUGE STANDARDS
SCALE: 1/2 ACTUAL SIZE

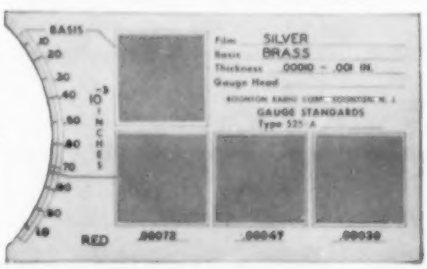


FIG. 1

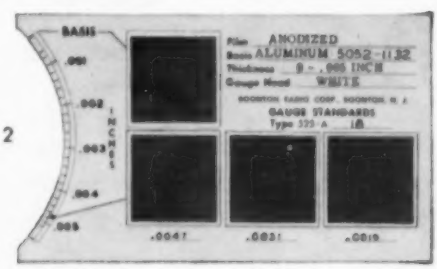


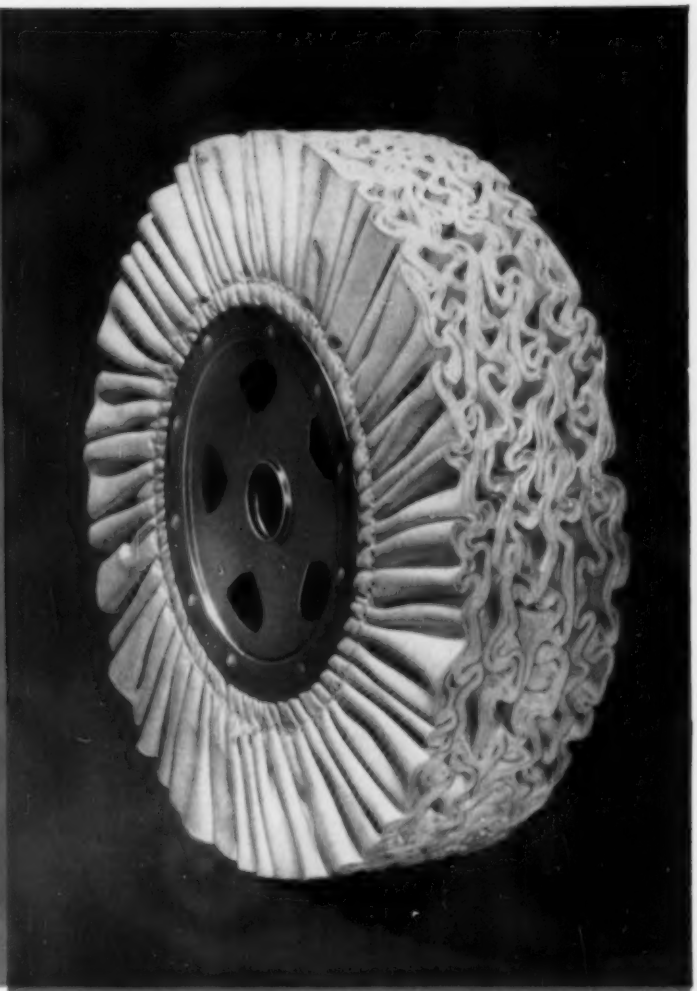
FIG. 2

BOONTON RADIO CORPORATION
Boonton, New Jersey

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 621.

WILLIAMSVILLE BUFF DIVISION
EST 1893 A1 ®
DANIELSON CONNECTICUT

NOW for Automatic Buffing



LET THE FAMOUS Williamsville CUTMASTER

- Precision-engineered for perfect balance throughout
- Perforated steel center gives cool running at highest speeds
- Cut on the bias for extra life
- High-count long fibre cotton will not fray or ravel

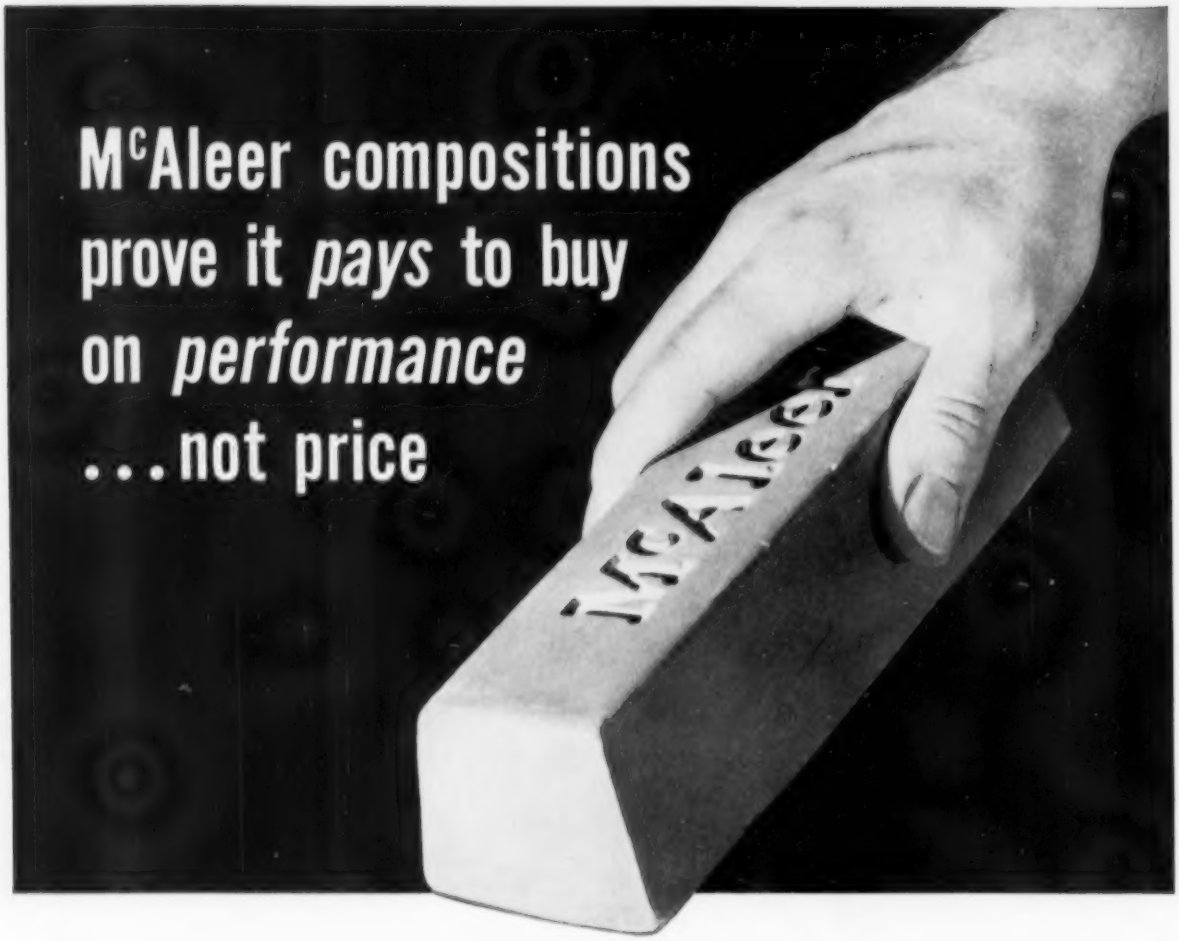
GIVE YOU LONGER SERVICE ... GREATER PROTECTION!

For over half a century, Williamsville Buffs have boosted production — cut overhead costs — in plants all over the country. Ask us for the answer to your buffing problems now — write, wire or phone!

WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company

DANIELSON • CONNECTICUT

McAleer compositions prove it *pays* to buy on *performance* ...not price



THERE's no denying it . . . the price paid for buffing and polishing materials is a most important factor in determining over-all metal finishing costs. Yet, all too often, material that is lowest in price may prove most expensive in the long run.

The threat to the investment represented in time and material alone, to bring an important part to the point of polishing and/or buffing, makes it imperative that you use a composition that is exactly "right" for your work. Rejections mean money and irretrievable man-hours are lost — to say nothing of how unbalanced finishing output affects regular production schedules.

C. H. McALEER
Founder and President

Cost-wise, production metal finishing operators avoid this risk by using McAleer *Quality-Controlled* compositions. They know from experience that the "job-fitted" characteristics of McAleer compounds invariably deliver *a value far beyond purchase price*. The value? Extra performance on the job, less waste, minimized rejects, increased work output and lower operating costs.

Whether you use extruded, bar-form or spray compositions it will pay you to make a proof-of-performance test of a McAleer composition that's specifically formulated to help you finish your job better, faster, at less cost.

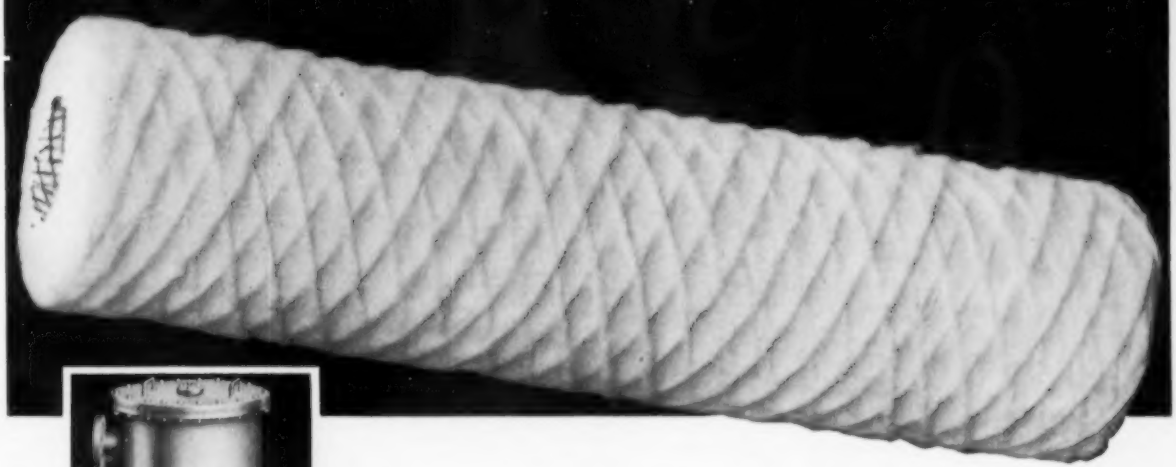
The way to better buffing and polishing for you can start with a phone call, wire or letter to McAleer. You make the start—we'll take care of the *finish*. Let's do it NOW!

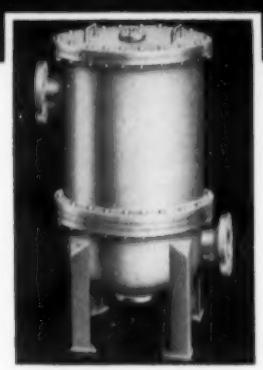
McAleer MANUFACTURING CORP.

101 S. WATERMAN AVE. ★ DETROIT 17, MICHIGAN

Since 1923, Manufacturers of *Quality-Controlled* Metal Finishing Materials

The INSIDE story of *Fulflo Filters*
For Continuous Micronic Clarity



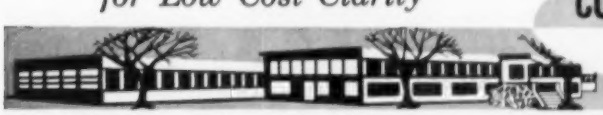


Inside every Fulflo Filter is the exclusive Honeycomb Filter Tube . . . engineered in a wide range of positively controlled densities to give you the exact degree of micronic clarity you want. Honeycomb Filter Tubes are made from cotton to resist almost any alkaline solution — dynel for resistance to acids. Hundreds of filtering tunnels provide true depth filtration at minimum pressure drop.

Fulflo Filters clarify any size tank *two or even three times an hour*. Compact size allows for installation on individual tanks, even where space is limited. Containers are available in steel, stainless steel, or rubber-lined steel. Fulflo is low in initial cost, economical to operate.

Fulflo Filters are engineered to your exact needs. Get higher plating quality with minimum rejects. For engineering assistance or technical literature, write Department PL.

Micro-Fine Filtration for Low Cost Clarity



COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

NEW SHAPED, EXTRUDED APW SILVER ANODES

STANDARD SHAPES

CONTROLLED GRAIN SIZE: APW EXTRUSION PROCESS* controls grain size within definite limits — minimizes sheddings

These scientifically shaped anodes retain 80% of original active surface area after 85% by weight has been plated off!

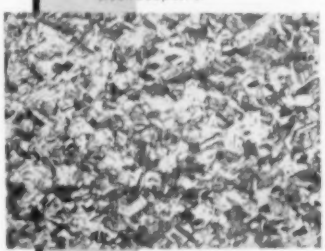
Costs are lowered by prolonged anode life, minimized polarization and less silver scrap to be refined.

In addition, the APW Extrusion Process controls grain size within definite ideal limits so that corrosion is smooth and uniform. Electrodeposits are *consistently* smooth. Shedding is virtually eliminated. Rejects are a comparative rarity!

We are anxious that the silver you buy in anodes is used most efficiently and economically. Special anode shapes will be engineered to meet your particular plating bath conditions. Call or write for a representative. We'll be glad to assist with your plating problems.

*Pat. Pending

ROLLED FLAT PLATE ANODE SECTION:
This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.



APW EXTRUDED ANODE SECTION:
Small, fully controlled regularity of grain size promotes uniform corrosion, smoothest electrodeposits, less rejects.

THE AMERICAN PLATINUM WORKS

231 NEW JERSEY RAILROAD AVENUE • NEWARK 5, NEW JERSEY

ENGELHARD INDUSTRIES

AIR FLOW

gives more dependable low-voltage power with much less maintenance

Chandeysson

GENERATORS

built for cool operation, regardless of reasonable overloads

You can count on smoother, more dependable operation and all-around lower maintenance with Chandeysson Motor Generators. They are carefully engineered and precisely built to eliminate costly overheating, with armature open construction for freedom of air flow. And, by the same token, they can take the kind of heat punishment other types of power conversion fail to offer. Generators can operate continuously at 40°C. room temperature . . . and, if necessary, at 50°C.

This is just one example of Chandeysson *performance* engineering. Behind every generator are decades of engineering and manufacturing know-how . . . consistent employment of only the finest, most durable materials . . . and user testimony to highest standards of performance and life-long service. For extra capacity to meet emergencies at the lowest possible cost . . . whatever your needs are in power conversion equipment . . . insist on Chandeysson low-voltage generators.

GET ALL THE FACTS on how you can gain lifetime power dividends with a Chandeysson Motor Generator set. Mail this coupon . . . Now!

CHANDEYSSON ELECTRIC COMPANY CHA-91
4078 Bingham Avenue, St. Louis 16, Mo.

Please send new booklet D-103

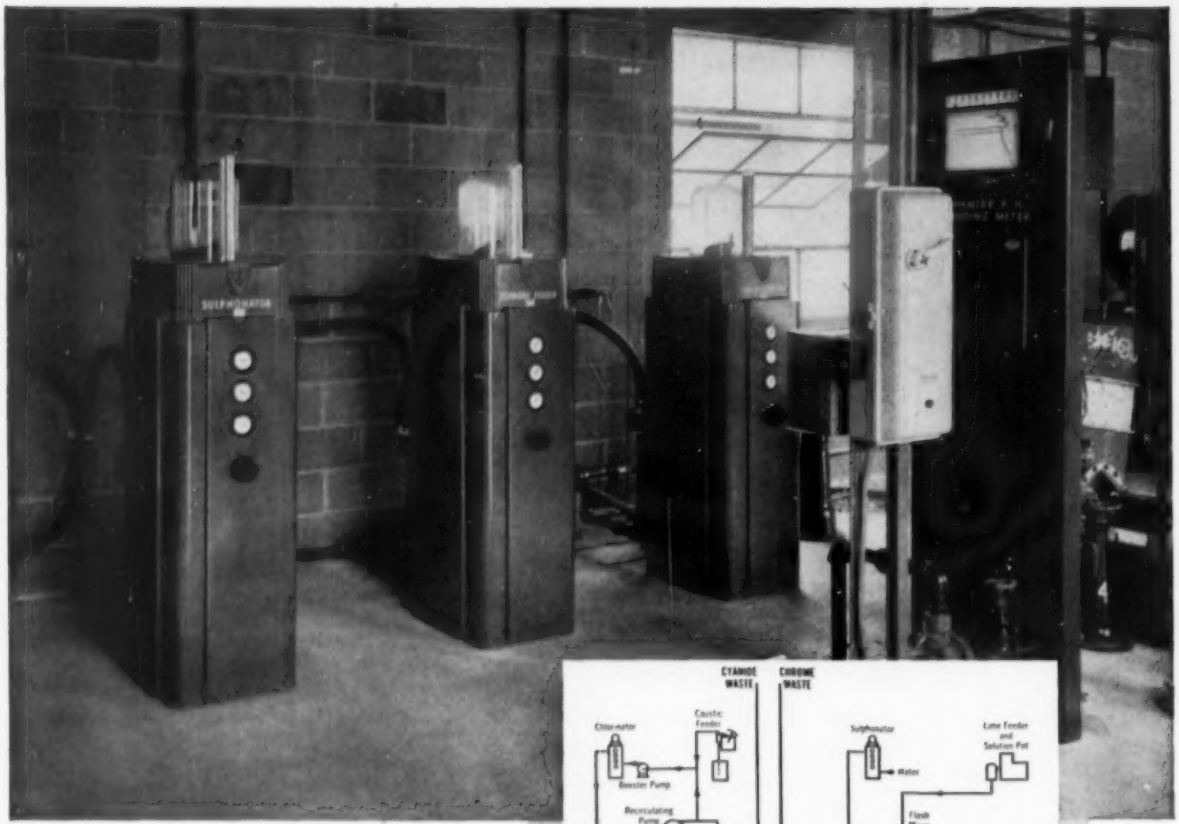
Name..... *Title*.....

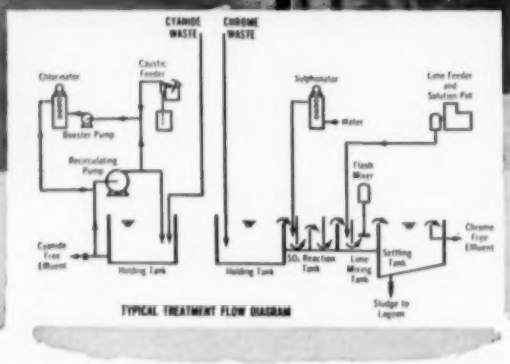
Company.....

Address.....

City..... *Zone*..... *State*.....

CHANDEYSSON ELECTRIC COMPANY • **4078 Bingham Avenue, St. Louis 16, Missouri**





TYPICAL TREATMENT FLOW DIAGRAM

DAYSTROM INSTRUMENT DIVISION USES

W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide to harmless carbon dioxide and nitrogen gas components.

The chromium bearing waste is treated with sulphur dioxide and lime, using a W&T Sulphonator and a W&T Dry Chemical Feeder. The treatment removes the toxic chromium and other heavy metals from solution, to be disposed of as sludge.

If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CP.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

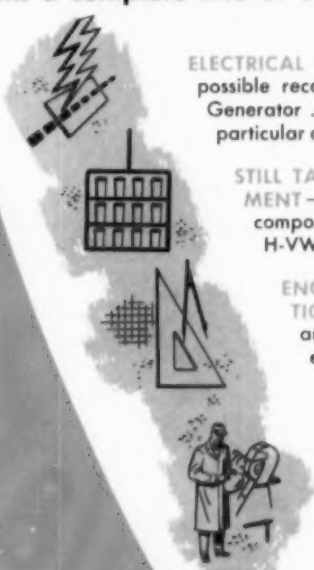
I-82

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 627.

INDICATE B 603. ➤

Aluminum
anodizing, buffing and cleaning

No matter what your aluminum finishing problem or need, you'll find the answer at H-VW-M . . . because it is the one company combining a complete engineering service with a complete line of equipment and supplies!



ELECTRICAL EQUIPMENT — Want the best possible recommendation of a Rectifier . . . Generator . . . or Control Equipment for your particular operations? Page 2 tells how to get it.

STILL TANK OR FULL AUTOMATIC EQUIPMENT — Whatever your need — from a single component to a complete, integrated system — H-VW-M supplies it . . . Page 3.

ENGINEERING SERVICE AND INSTALLATION — H-VW-M engineers and technicians are anodizing equipment specialists, with years of experience. Page 3 tells why these H-VW-M services mean greater efficiency and savings in your plant.

ALUMINUM FINISHING SUPPLIES — Page 4 shows how H-VW-M research has resulted in new compounds, improved buffs and cleaners to make aluminum finishing easier, better.

HANSON-VAN WINKLE-MUNNING CO. MATAWAN, NEW JERSEY, U.S.A.

HANSON-VAN WINKLE-MUNNING COMPANY

MATAWAN, NEW JERSEY

Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies

Plants: Matawan, New Jersey • Grand Rapids, Michigan

Sales Offices: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Boston • Bridgeport • Chicago Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville • Matawan Milwaukee • New York • Philadelphia • Pittsburgh • Plainfield (N. J.) • Rochester • St. Louis San Francisco • Springfield (Mass.) • Utica • Wallingford (Conn.)

These H-VW-M Anodizing and Finishing to New Savings, New Efficiency, New

ELECTRICAL EQUIPMENT

H-VW-M is the only manufacturer of both Germanium and Selenium Rectifiers *and* low voltage, direct current Motor Generator Sets for the metal finishing industry. This thorough experience in every phase of low voltage power generation and rectification means that when you bring your power problems to H-VW-M you're sure to get the perfect equipment recommendation.

Self-Contained Rectifier with Tap Switch Control

Remote Controlled Rectifier with Tap Switch Control

Germanium and Selenium Rectifiers . . . Rectifier Controls

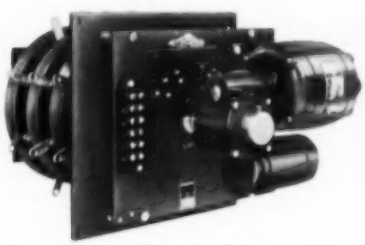
Highest quality and efficiency, flexibility, economy and low maintenance are the characteristics combined in H-VW-M's full line of both Germanium and Selenium Rectifiers. 6 to 48 volt units—both remote and self-contained—provide the exact direct current low-voltage and high amperage required in aluminum anodizing. The widest possible choice of controls and control combinations is available. Such devices as manual or motor operated tap switch controls, continuously variable auto-transformers and saturable core reactors are used with or without supplemental controls to provide automatic voltage stabilization, automatic constant current as well as automatic programming.

Write for Bulletin ER-108, which gives further information about Rectifiers and Controls, plus useful control application suggestions.

Manual Tap Switch Control

Saturable Core Reactor

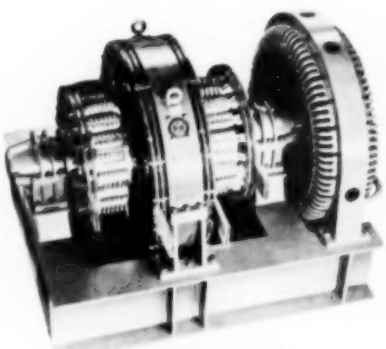
Continuously Variable Auto-Transformer



Motor Operated Tap Switch Control

Generators . . . and Controls

H-VW-M Motor Generators designed especially for metal finishing operations are built in sizes up to 50,000 amperes, and accessory equipment includes a full line of controls and control panels to cover any desired control function. Easy-to-maintain H-VW-M Motor Generators have exceptionally rugged and practical construction features insuring maximum performance and life. Standard voltage ratings range from 6 to 50 volts, and include the 18 and 24 volt units usually required for sulphuric acid anodizing, plus the 40 and 50 volt units used in chromic acid anodizing. Write today for 24-page Bulletin G-104, covering in detail all H-VW-M Generators.



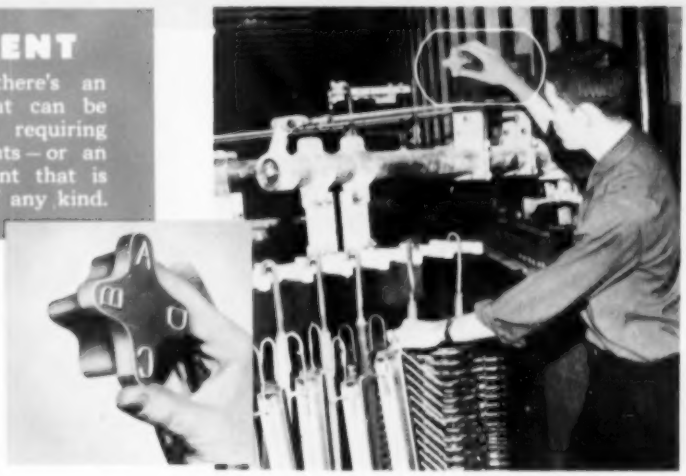
15,000 Ampere, 6-Volt Generator Unit

Automatic Anodizing Control Panel

Supplies, Equipment and Services Add Up Simplicity of Operation in Your Plant

PROCESSING EQUIPMENT

Whatever your anodizing procedure, there's an H-VW-M Full Automatic Conveyor that can be adapted to any production application requiring automatic cycling of individual treatments—or an H-VW-M Tank with accessory equipment that is perfectly adapted to still tank methods of any kind.



Workman "dials" desired cycle in refrigerator plant. Parts will by-pass or lower into baths as dial setting dictates.

Automation in Metalfinishing— *Full Automatic Conveyors with Dial-A-Cycle*

H-VW-M's new DIAL-A-CYCLE system automates nine or more complete metalfinishing processes on a single anodizing or electroplating machine. This revolutionary by-pass mechanism can be used on any metalfinishing installation for anodizing, electroplating, or similar processing. It is especially useful and effects substantial cost reductions when a variety of parts requires several different processes or colors.

DIAL-A-CYCLE, as the name implies, is controlled by a simple dial setting. The dial is mounted on the carrier arm that carries the parts through processing tanks. It is set by the machine operator for the processing steps through which each load of unfinished parts is to move. Automatic conveying then takes over, lowering the parts into the required tanks and bypassing others.

Different products, requiring different anodizing cycles, may be processed at the same time, with the same equipment. DIAL-A-CYCLE gives you new versatility while reducing operating, labor, and maintenance costs. Close, automatic control of transfer and immersion periods improves quality.

DIAL-A-CYCLE is the newest of many types of conveyors and equipment H-VW-M supplies to aluminum finishers. H-VW-M also design, manufactures, and installs return-type conveyors . . . elevator conveyors . . . straight-line conveyors . . . and others. For a complete description of all types, write for Bulletin FA-105.

Tanks and Equipment

At H-VW-M—the plating and anodizing industry's workshop—you'll find tank equipment for every phase of your work. For chromic acid anodizing, H-VW-M double electric welded unlined steel tanks are offered, along with steel coil equipment for cooling and heating. The entire system is H-VW-M designed, supplied and installed. For sulphuric acid anodizing, lead-lined steel tanks, plus the necessary cooling coils and air agitation assembly, are supplied. Tanks are fabricated from hot rolled steel, stainless steel, and aluminum. Other types of tanks are also available. Bulletin No. T-108 gives full particulars about this important H-VW-M equipment. Every conceivable type of auxiliary equipment is engineered and supplied, according to customers specifications, including a complete packaged refrigeration system for anodizing solutions.

And H-VW-M's Engineering and Installation Service

Anodizing problems of *any* kind? H-VW-M is prepared to set up your entire anodizing system from beginning to end—a system made up of components scientifically engineered to work together with utmost efficiency. Because of this, and because of H-VW-M's continuing research and development in every aspect of the anodizing picture, you can be confident that the recommendation you receive from H-VW-M is the very *best*.

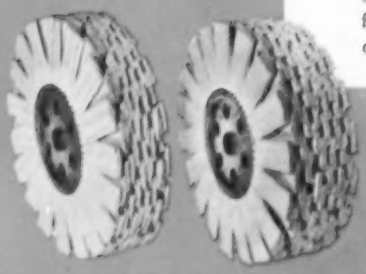
What's more, if requested, H-VW-M sees to it that the equipment you buy is H-VW-M *installed*. This means perfect, efficient operation from the start.

Add to this the fact that an H-VW-M technical representative—ready to serve you—is no further than your telephone. These representatives serve in principal cities across the nation. Get to know the one nearest you. He can help you get the most from your aluminum finishing equipment and supplies.

TURN THE PAGE FOR ALUMINUM BUFFING AND CLEANING SUPPLIES

ALUMINUM BUFFING AND CLEANING SUPPLIES

Since aluminum came into its own after World War II, considerable H-VW-M research and development work has been devoted to the perfection of buffs and compounds suiting the unique physical characteristics of this popular light metal. When long-wearing H-VW-M Buffs are used in conjunction with H-VW-M compounds especially formulated for aluminum finishing, you have the perfectly balanced combination for economy, efficiency and quality performance.

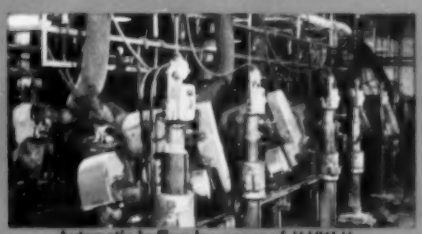


Buffs

Nowhere will you find a wider selection of the buffs you need for preanodizing operations than at H-VW-M. Whether you're looking for a super-heavy-duty buff like new steel-centered Ruff-L-Buffs (which are available untreated, or Binderized® for extra long wear) medium duty buffs like Triplex Buffs, or a buff for medium-to-light service such as the Full Disc Buff, you need look no further than H-VW-M. The full H-VW-M line also includes new Tufta-Flex Buffs (cloth tufts) and Sisal-Flex Buffs (with sisal-centered tufts).

Among this array you'll find the exact buffs for your aluminum finishing needs. Every one is characterized by first quality, uniform new material of close weave and good weight . . . tight sewing with heavy thread . . . and proper balance. Write for 12 page Bulletin B-103, which describes H-VW-M's entire buff line.

Hand buffing using H-VW-M buffs, compounds.



Automatic buffing by means of H-VW-M Liquimatic System.

Compounds

For heavy duty cutting, H-VW-M Liquid Tripoli Compounds 303 and 420 were developed, and are now widely used in the cooking utensil industry. For the appliance, storm window, construction materials and automotive fields, H-VW-M's new Liquimatic Liquid Compound No. 728 has proved especially successful, giving excellent cut, while leaving the surface with deep, high color.

H-VW-M Bar Compounds also find broad use in aluminum finishing. A variety of tripoli bar compounds are offered in varying consistencies to meet all cutting requirements. For cut and color, special white compounds are available. And for high color, several new H-VW-M aluminum oxide compounds—No.'s 6-B-168, 6-B-72 and 8390—give unusually good results. Write for Bulletin CO-103.

Cleaners

H-VW-M devotes constant research to the subject of cleaners in its search for ever better products in the aluminum finishing field.

Matawan Cleaners are designed specifically to give superior results in soak cleaning, power spray operations, oxide removal, and for special aluminum cleaning and etching operations. Of particular interest is H-VW-M's 858 Cleaner, which prevents scale formation, thus keeping coil and tank walls scale free. This unusual aluminum cleaner leaves an extremely bright surface, and, because of its built-in regenerator, makes maximum effective use of caustic in the bath.

In line with its desire to supply the exact cleaner for the job, H-VW-M offers its extensive laboratory facilities where circumstances demand a special cleaner.

When you think of aluminum finishing equipment and supplies—think of H-VW-M first. Buying from one dependable source . . . H-VW-M . . . means one company assumes full responsibility—your guarantee that you're getting the best . . . in products . . . in performance, in *extra* service.

PLATEMANSHIP

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, N. J.

Plants: Matawan, N. J. • Grand Rapids, Mich.

SALES OFFICES: Anderson (Ind.) • Baltimore • Beloit (Wisc.) Boston • Bridgeport • Chicago • Cleveland • Dayton • Detroit Grand Rapids • Los Angeles • Louisville • Matawan Milwaukee • New York • Philadelphia • Pittsburgh • Plainfield Rochester • St. Louis • San Francisco • Springfield (Mass.) Utica • Wallingford (Conn.)

H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Printed in U.S.A.

FURTHER STUDIES OF AN ELECTRONIC THICKNESS GAGE:

Circuitry, Operating Characteristics, and Calibration

by Frederick P. Brodell* and Abner Brenner†

An electronic thickness gage based on the skin effect had been previously developed for measuring metallic coatings on nonmagnetic basis metals. It was improved by using a bridge circuit and by designing the gage head so that an adjustment of it—"peaking"—could be performed conveniently. Because peaking is important for obtaining reproducible measurements, the following factors that affect peaking were studied: curvature and nature of basis metal and capacitance across probe coil. A study of the calibrations of the gage for several combinations of coatings and basis metals showed that (1) the calibrations of different gages were similar, (2) nickel coatings could not be accurately measured except under restricted conditions, (3) measurements of poorly conductive and nonconductive coatings required a slightly different technique than measurements of highly conductive coatings.

I. INTRODUCTION

An electronic thickness gage has been developed which utilizes the principle of the skin effect to measure the thickness of metallic coatings on a metallic basis metal. Because of the interest shown in the possible applications of the gage to industrial use, further study of the gage was warranted. This report is a sequel to the earlier one [1] and describes several aspects of the circuitry, operating characteristics, and calibration of the gage that are important for its routine utilization. A gage based on the design herein described is now commerciallyav ailable.‡ Some of the information contained in the previous report will be briefly reviewed here so as to make this report self-contained.

The operation of the gage depends upon the skin effect which is the tendency of alternating currents to travel closer and closer to the surface as the frequency is increased. With other parameters fixed, the strength of the current depends on the conductivity of the surface layers. The thickness gage utilizes a small probe coil energized with an alternating current of radio frequency to induce an eddy current in a plated metallic surface. The frequency of the current is so chosen that by virtue of the skin effect an appreciable proportion of the eddy current flows in both the basis metal and the coating. Provided that the coating and basis metal have different electrical conductivities and/or magnetic properties, the strength of the induced eddy current varies with the thickness of the coating. The strength of the induced current is indirectly measured through the interaction of its magnetic field with the probe coil. The net result is a change in the apparent impedance of the probe coil. The current through the probe coil changes correspondingly and the amount of the change or the unbalance of a circuit is measured with a microammeter.

The thickness of a coating is thus translated into a change in the reading on a microammeter. By calibrating the gage with standard coatings of known thickness, the meter readings are directly related to the thickness of the coatings.

Since the gage is based on the skin effect it has been named the "Dermitron" from the Neo Latin word Dermis, which is derived from the Greek word Dermos, meaning skin. The gage will be referred to by this name.

For convenience the Dermitron is considered to consist of three units: (1) an oscillator, (2) a gage head which contains the probe coil, and (3) a detector circuit which indicates changes in the current flowing through the probe coil. The type of oscillator used for the gage is not important. Several types, with and without crystal control, operated satisfactorily. To develop the gage described in the earlier publication into an instrument suitable for commercial utilization, improvements in the detecting circuit and gage head were necessary.

The successful application of the gage to routine measurements of the wide variety of coatings and basis metals that occur in commerce required more knowledge of the

* Convair, San Diego, California.
† National Bureau of Standards, Washington, D. C.
‡ Unit Process Assemblies, Inc., 61 East Fourth St., New York 3, N. Y.

operating characteristics of the gage. This report deals with the study and importance of these characteristics. For example, the adjustment of "peaking" which was described in the earlier publication was found to be more important for obtaining reproducible measurements than was previously realized, the measurement of the thickness of nickel coatings was not sufficiently accurate for routine purposes except under limited conditions, and the measurement of the thickness of nonconductive coatings on a basis metal required a slightly different technique than the measurement of conductive coatings.

II. METHOD OF CALIBRATING AND MAKING MEASUREMENTS

Before calibrating the Dermitron with standards of known thickness, the probe coil ordinarily is "peaked," usually on an unplated specimen of the basis metal. In making this adjustment, the probe is brought near the surface of a bare piece of basis metal and then withdrawn slowly. The needle of the microammeter first moves in one direction, then stops, and begins to move back, that is, the reading goes through a maximum or minimum. When the meter registers a minimum or maximum reading, the probe coil is peaked and the distance from the lower end of the probe coil to the surface of the specimen is called the peaking distance. This distance is held constant in subsequent measurements of any coating plated on the same basis metal. With the gage heads described later in this report, peaking and maintenance of the probe coil at the peaking distance is easily accomplished. The subject of peaking is described in more detail in section V.

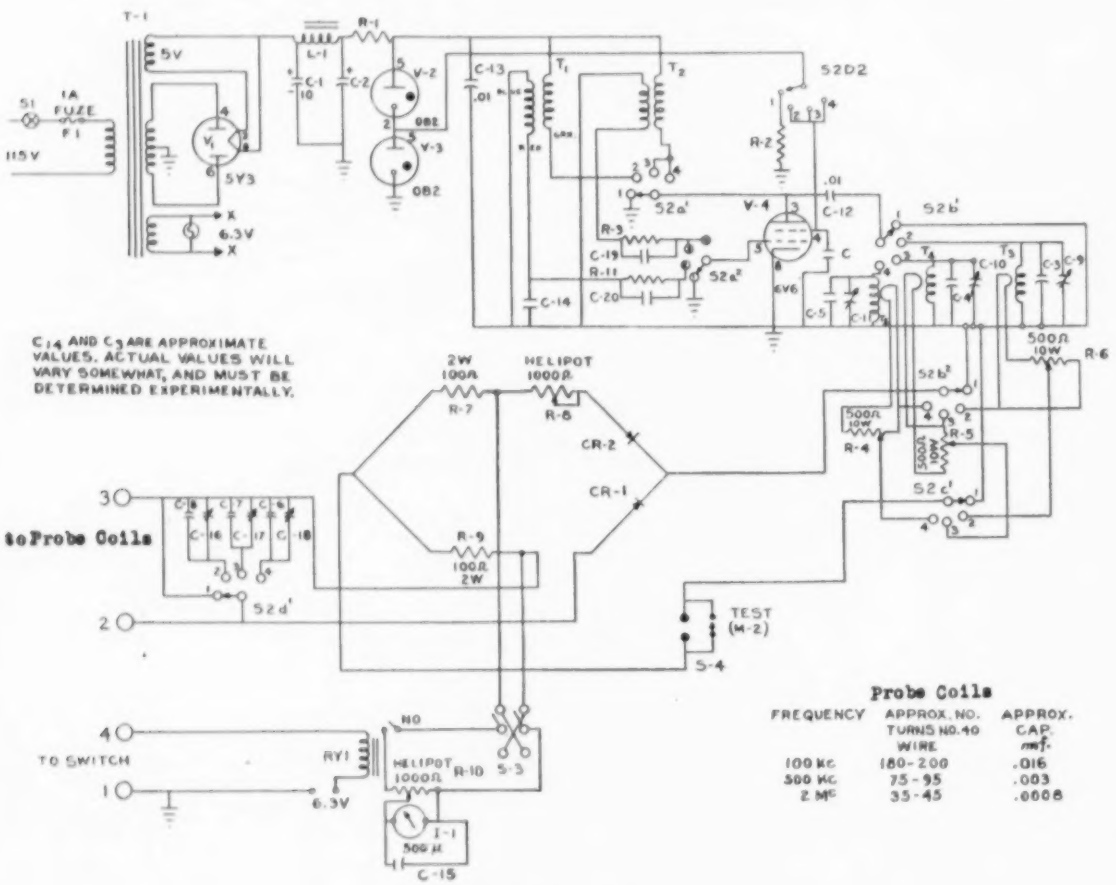
To make a calibration curve the following steps are taken:

(1) The frequency knob is turned to a frequency suitable for the range of thickness to be measured. For thicknesses up to 1 mil, a frequency of 2 Mc is used. For thicknesses up to 6 mils, a frequency of 0.1 Mc is used.

(2) The probe coil is peaked on the unplated basis metal.

(3) The meter is set to read zero while the probe coil is so placed. This adjustment establishes the scale for zero thickness of coating.

(4) The upper end of the calibration scale is set by placing the probe on a thick specimen of coating, for example, 5 or 10 mils thick, and adjusting the sensitivity knob to cause the meter to read full scale. The exact thickness of



Probe Coils

FREQUENCY	APPROX. NO. TURNS NO. 40 WIRE	APPROX. CAP. mmf.
100 Kc	180-200	.016
500 Kc	75-95	.003
2 Mc	35-45	.0008

Fig. 1.—Circuit Diagram of Dermitron.

coating used for setting the upper end of the scale is unimportant, because the Dermitron gives a constant reading for thicknesses of metal greater than the depth of penetration of the eddy currents.

(5) The zero point of the meter should now be checked, as it may have shifted slightly.

(6) After the upper and lower ends of the scale are set, readings are taken with the Dermitron on standards having thicknesses of coatings in the desired range.

(7) A calibration curve of coating thickness against meter reading is then drawn.

The adjustment of the gage for the calibration may be varied somewhat from the above procedure. For example, the probe coil may be peaked on a thick layer of coating instead of on the basis metal, or the upper end of the scale can be set for a coating of known thickness.

To measure the thickness of an unknown, the gage is adjusted and readings taken in the same manner as for a calibration.

III. CIRCUIT

The circuit of the oscillator and the detector circuit of the Dermitron are shown in Fig. 1 along with the list of parts. The gage head is illustrated and described in a following section of this report. As already noted, the type of oscillator is not important provided it is stable, and this part of the circuit does not need to be discussed further. The detecting circuit is in the center of the Figure and comprises the hexagonal shaped bridge circuit.

In the previous publication two detector circuits were described and considered as being equally satisfactory. One of these contained a rectifier in each of two parallel arms and was named the "branch circuit" (see ref. 1, Fig. 5). The microammeter was in the main circuit feeding the two branches. The other was a bridge circuit with a rectifier in each of two arms (see ref. 1, Fig. 4) and a meter between the two arms. The bridge circuit is the one shown in Fig. 1.

Further experience with the two circuits showed that although the branch circuit was about twice as sensitive

Parts List—Brenner-Garcia Dermitron Thickness Gage

Part No.	Description	Function
C-1, C-2	Dual 10-10 ufd 450 w.v. Electrolytic	Power supply filter
C-3	6800 uufd Mica	Fixed tuning capacitor for T-3
C-4	2200 uufd	Fixed tuning capacitor for T-4
C-5	300 uufd Mica	Fixed tuning capacitor for T-5
C-6	900 uufd Mica	Fixed probe tuning capacitor for 2 mc pos.
C-7	3000 uufd Mica	Fixed probe tuning capacitor for 500 k.c. position
C-8	.016 ufd Mica	Fixed probe tuning capacitor for 100 k.c. position
C-9	100-580 uufd Mica trimmer	Trimmer cap. for T-3
C-10	100-580 uufd Mica trimmer	Trimmer cap. for T-4
C-11	100-580 uufd Mica trimmer	Trimmer cap. for T-5
C-12	.01 ufd Mica	Output coupling capacitor
C-13	.01 ufd Mica	Power supply filter
C-14	.0015 ufd Mica	Fixed Tuning capacitor for T-1
C-15	.02 ufd 400 v paper	Meter bypass capacitor
C-16	100-580 uufd Mica trimmer	Probe trimmer—100 k.c.
C-17	100-580 uufd Mica trimmer	Probe trimmer—500 k.c.
C-18	100-580 uufd Mica trimmer	Probe trimmer—2 m.c.
C-19	.0001 ufd Mica	Grid 1 R.F. bypass for 500 k.c., 2 m.c.
C-20	.005 ufd Mica	Grid 1 R.F. bypass for 100 k.c.
CR-1 CR-2	3 ea. type 1N34A diodes in parallel	Bridge rectifier
F-1	1 ampere fuse	Power supply fuse
I-1	0-500 ua Meter, general Electric type DO-78	Indicating Meter
L-1	Choke, 8 henries 70 ma	Power supply filtering
PL-1	Socket, amphenol type 91-PC4F	Probe socket
R-1	500 ohm 5 watt	Power supply dropping resistor
R-2	6.8K 10w, wirewound	Power supply loading resistor for standby
R-3	20K 1W	Grid resistor
R-4, R-5, R-6	500 ohm, 10 watt Adjustable	Bridge current Adjustment
R-7, R-9	100 ohms 2 watt	Bridge resistors (fixed arms)
R-8	1000 ohm, 10 turn Helipot	Bridge balance
R-10	1000 ohm, 10 turn Helipot	Meter sensitivity
R-11	20,000 ohm	Grid resistor
RY-1	6.3 Vac, SPST N. O. Relay	Probe Relay
S-1	D.P.S.T. Toggle Switch	Power Switch
S-2	4 Position 7 gang Switch (4 decks) Ceramic wafers	Band change switch
S-3	D.P.D.T. Toggle Switch	Meter reversing Switch
S-4	S.P.S.T. Toggle	Test switch
T-1	Power Transformer 5 V at 2 amps. 6.3 v a 3 a 670 v. CT at 70 ma	Power supply
T-2	National type S 7746 I.F. Transformer	100 kc feedback coil
T-3	Transformer, primary 78 turns of # 29 wire wound on Nation X R-2 form. Secondary 35 turns of # 29 wire wound on top of primary	500 kc and 2 ma feedback coil
T-3	100 kc output transformer primary 448 turns of # 32 wire wound in 14 slots. Secondary 44 turns of # 30 wire wound on top of primary. Contained in Millen type 74001 form (see dwg. of coil form details)	100 kc output coil
T-4	500 kc output transformer Primary 130 turns of # 30 wire, wound on Millen type 74001 coil form	500 kc output coil
T-4	Secondary 44 turns of # 30 wire, wound on top of primary	Use
T-5	2 mc output coil primary 50 turns of # 26 wire wound on Millen type 74001 coil form. Secondary 18 turns of # 26 wire wound on top of primary	2 mc output coil

Electrical Constants

T-3, Primary 940 uh, Q = 22.5
Secondary 140 uh, Q = 5
M = 300 uh

T-4, Primary 120 uh, Q = 55
Secondary 28.5 uh, Q = 5
M = 24 uh

T-5, Primary 20.5 uh, Q = 60
Secondary 6.1 uh, Q = 24
M = 13 uh

as the bridge circuit, the latter had certain conveniences and, therefore, was selected for construction of the Dermitron. The most important advantage of the bridge circuit is that only the unbalanced current flows through the meter. Consequently, if the bridge circuit is balanced, that is the meter set to read zero, no current at all flows through the meter. On the other hand, in the branch circuit the entire current which is alternating flows through the meter and its associated components at all times but does not register, since the meter responds only to direct current.

The negligible flow of current through the meter gives the bridge circuit three advantages over the branch circuit. First, a much more sensitive meter, even a galvanometer, can be used without danger of damage by an excessive flow of current; second, the meter can be more readily adjusted to zero; and third, the sensitivity of the circuit is more easily adjusted. In making a calibration curve, the latter adjustment is particularly important for obtaining a reading on the meter with the thickest standard coating. The adjustment of sensitivity not only must be convenient, but also must cause no more than a slight shift of the zero point of the meter. The adjustment of sensitivity caused a large shift in the zero setting of the branch circuit but had only a slight effect on that of the bridge circuit. The sensitivity of the bridge circuit is varied by simply varying the voltage across the meter (see Fig. 1) with a potentiometer.

An important requirement in obtaining steady readings with the gage is that the current at all times pass through the probe coil, regardless of whether the meter circuit is open or closed. The purpose of this is to prevent an appreciable variation in the temperature of the probe coil and other circuit elements and thus prevent a drift in the meter readings. Continuous passage of current without danger of damaging the meter is easily accomplished with the bridge circuit, since the meter is not in the main circuit.

One minor difficulty encountered in the development of the gage was the fluctuation of readings when the cable to the gage head was flexed. This was prevented by the common expedient of twisting the lead wires, which consisted of No. 30 enameled copper wire.

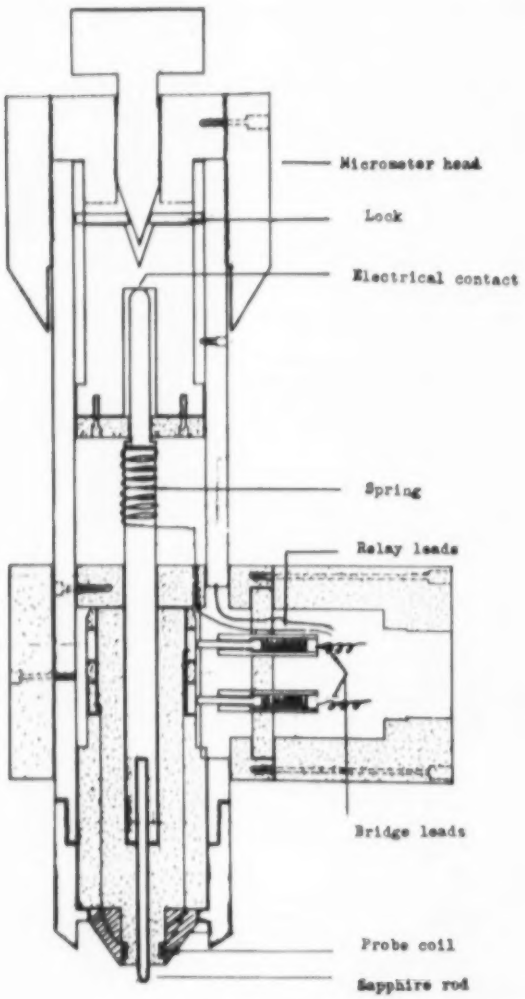


Fig. 2.—Gage head with removable coils and with automatic switch for microammeter.

IV. CONSTRUCTION OF THE GAGE HEAD

The gage head is essentially a device in which the probe coil is mounted, suitably protected, and electrically shielded. The gage head may be mounted on a stand or held in the hand. The probe coil described in the previous publication consisted of fifty to several hundred turns of No. 40 wire wound on a sapphire bobbin 0.03 in. in diameter and 0.03 in. long. The probe coil of the improved gage is somewhat larger because the bobbin had to be provided with a hollow core for reasons that are discussed later. The bobbin is of plastic, 0.18 inch in diameter, 0.03 to 0.06 in. long, and has an axial hole 0.06 in. in diameter.

To provide a convenient means for varying the distance of the probe coil from the specimen when peaking, a sapphire rod about 0.06 in. in diameter with a rounded lower end was placed along the axis of the hollow coil form. It was moved in or out by means of a screw attached to its upper end. The rounded end of the rod provided a single point of contact of the gage head with the specimen.

There are two other minor requirements for a satisfactory gage head. It must be adequately shielded so that it can be held in the hand without the readings being affected and it should automatically open the meter circuit when lifted from the surface of the specimen. The last requirement emanates from the need for protecting the meter. When the gage head is raised from the surface of a metal, the circuit becomes very unbalanced and the needle of the meter may swing off-scale with sufficient force to be damaged. This precaution, however, is not necessary with a meter having a movement with considerable inertia, for example, the Weston Model 643.

A gage head satisfying the requirements set forth in the preceding discussion is shown in Fig. 2. This type of

gage head was used in the measurements reported in this paper. The sapphire rod is spring loaded so that it protrudes considerably beyond the end of the probe coil. When the gage head is pressed against a specimen the metal mounting of the sapphire rod is pushed up against a metal stop in the top of the gage head to make electrical contact and close the meter circuit. By this arrangement, the meter circuit which is normally open is automatically closed when a reading is taken. The position of the stop is set by a micrometer screw.

This gage head has another useful feature in that it can operate on any one of three selected frequencies. Each frequency requires a separate probe coil, but the various probe coils are interchangeable. To change the probe coil, the end of the gage head is unscrewed, the probe coil slipped out, and another substituted.

Although this gage head operated satisfactorily it had the disadvantage of being expensive to construct and was subject to some minor mechanical difficulties, such as the occasional binding of the sapphire rod. For this reason two simpler types of gage heads were constructed in which the probe coil was permanently mounted as shown in Figs. 3 and 4. Consequently, a different gage head was required for each frequency. For the purpose of peaking, each gage head was provided with a sapphire rod actuated by a screw. A simple gage head is shown in Fig. 3. The probe coil was set in plastic inside of a brass tube which served as an electrical shield. No device for opening the meter circuit was provided. The gage head shown in Figure 4 was provided with a pistol-grip and a trigger for closing the circuit of the meter. Fig. 5 shows a Dermitron gage in operation.

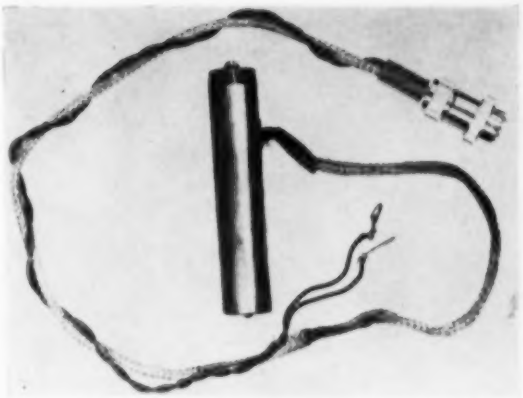


Fig. 3.—Simple gage head with point contact and screw adjustment. The probe coil is embedded in plastic and is situated several mils from the lower end of the tube.

V. "PEAKING"

In the first stages of the development of the Dermitron gage, measurements were made with the probe coil placed either in contact with the specimen or at an arbitrary fixed distance from it. The measurements were poorly reproducible because of large effects of inclination of the probe and curvature of the specimen. By making measurements with a peaked probe coil the effects of inclination and curvature were considerably reduced and the measurements were satisfactorily reproducible. Because of the importance of peaking the factors that affect it were studied in detail.

As already noted, peaking involves moving the probe coil relative to a metal surface. The nature of peaking is made clearer by a graph of the relation between current and the distance of the probe coil from the metal surface (see Fig. 6). The minimum point of each curve indicates that in each case the probe coil was peaked, and the distance of the probe coil from the metal surface when this minimum occurs is the peaking distance. Peaking is best performed with the meter set at a low sensitivity so that the needle does not go off-scale during the procedure.

The operation or adjustment of peaking must not be confused with the similar operation of bringing a circuit into resonance. The detector circuit of the Dermitron can be conveniently brought into resonance by varying the capacitance across the probe coil (with the latter at a fixed given distance from a metal surface) until the reading on the meter passes through a maximum or minimum. A resonant circuit is not necessarily peaked, and conversely, a circuit which has been peaked is usually not at resonance. This is readily demonstrated by varying the capacitance across a peaked probe coil. The deviation of a peaked circuit from resonance can be conveniently noted by the change in capacitance required to bring the circuit into resonance, and this change can be used as a measure of the difference between a peaked and resonant circuit. In some instances, particularly at 2 Mc, the differences were small, amounting to several ten-thousandths of a microfarad. At 0.1 Mc the differences were larger. For example a probe coil with a 0.021 mf capacitance across it was peaked on nickel. The circuit was brought into resonance by decreasing the capacitance to 0.013 mf.

The difference between the operation of the Dermitron with a peaked probe and with a resonant circuit is of more than academic importance. The sensitivity of measurements is lower at the resonance point and may be negli-

Fig. 4.—View of disassembled gage head with micrometer screw, pistol-grip handle, and trigger switch. Probe coil is mounted as described in Fig. 3.

Fig. 5. Dermitron gage in operation with gage head of Fig. 4.

gible, and the detrimental effect of inclination of the probe is not diminished as much as with peaking. However, bringing a circuit into resonance is of value, because it brings the circuit into a condition that is convenient for peaking.

The peaking distance, that is the distance from the bottom of the probe coil to the surface of the specimen, is not unique, but is affected by several factors, among which are: capacitance across the probe coil, curvature of the surface of the specimen, and type of metal surface.

(a) Capacitance across the probe coil.

In an instrument for routine measurements, the electrical constants of the circuit presumably would be fixed, so that this factor would not be important, but in this study we were interested in this as well as the other two factors.

The peaking distance can be varied by changing the magnitude of the capacitance across the probe coil (C-6, C-7, or C-8 of Fig. 1). The sequence of adjustments was to select a capacitance first, then hold it fixed while the probe coil was moved in the manner previously described. To obtain peaking of the probe coil at a desired distance repeated trials were made in which the capacitance across the probe coil was first varied in steps and peaking then performed for each variation. Peaking was obtained only with a very limited range of values of the capacitance across the coil. If the capacitance was outside of this range, the readings of the meter changed unidirectionally as the probe coil was moved away from the metal surface.

(b) Curvature of specimen.

The peaking distance of a probe coil varies with the curvature of a surface and is less for a convex than for a plane surface. A probe coil peaked on a plane surface may have to be moved as much as 10 mils closer to a convex surface to obtain peaking. To allow for this motion, a gage used for routine measurements should have the circuit constants set so that the probe coil peaks at a distance of 15 to 20 mils from a plane metal surface. In the measurements which are to be described in the remainder of this paper the probe coil peaked at about this distance unless otherwise noted.

(c) Type of metal.

The peaking distance varies with the nature of the metal surface. This means that a probe which has been peaked on the basis metal may not be peaked when placed on the coating. This variation of peaking distance occasions no difficulty with measurements on combinations of nonmagnetic metals because the peaking distance varies only a few mils. For practical purposes the probe coil can be peaked on copper or brass and used on other nonmagnetic metals.

The peaking distance of the probe coil from a nonmagnetic metal may be appreciably different from the peaking distance from a magnetic metal. This is illustrated by the abscissa of the two minima in Fig. 6, obtained at 2 Mc. At 0.1 Mc a probe coil peaked on a nonmagnetic metal, could not be peaked on a magnetic metal, and vice-versa, unless the value of the capacitance across the probe was also changed. Otherwise, when peaking was attempted on the second metal the meter readings changed unidirectionally with distance of the probe coil from the metal surface, and no minimum was obtained as in Fig. 6. As an example of the effect of the metal surface on peaking: with a frequency of 0.1 Mc and a peaking distance of about 15 mils, the following capacitances across the probe coil were required for steel, copper, and nickel, respectively, 0.0112 mf, 0.0169 mf, and 0.0210 mf.

VI. CALIBRATION CURVES

Effect of Distance of Probe Coil and of Peaking.

To measure the thickness of a coating on an unknown specimen the Dermitron must be in the same state as when the calibration was made. Specifically, the electrical con-

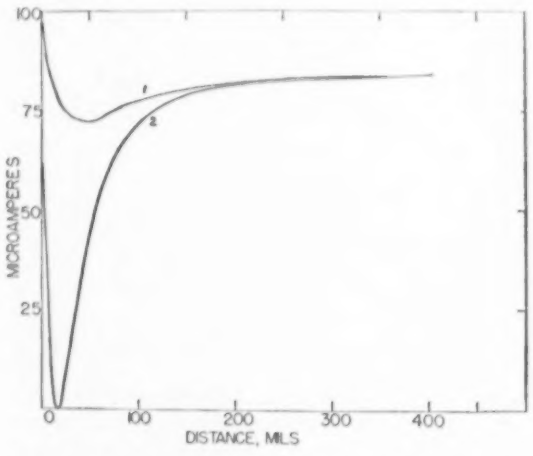


Fig. 6. Variation of readings of Dermitron with distance of probe coil from a metal surface. The abscissae of the minima are the peaking distances. Curves 1 and 2 are for steel and copper, respectively.

stants of the circuit, particularly the probe capacitor, and the distance of the probe coil from the surface of the metal must be the same as when the calibration was made. The first precaution is not important, since an instrument used for routine measurements would have fixed values of the electrical components, including the capacitor across the probe. However, the distance of the probe coil from the specimen is purposely made variable to permit peaking. The simplest way to set the probe at a reproducible distance from a surface is to set it at the peaking distance, as this can be done without making an actual measurement of distance.

Curves 1, 2, and 3 in Fig. 7 illustrate the different calibration curves that were obtained with the probe coil set at different distances from the metal surface. These are calibration curves of silver coatings on a nickel silver basis metal. Curve 1 represents three sets of data obtained with the probe coil set at about 4, 18, and 33 mils from the metal surface and the probe coil capacitor set so that peaking occurred in each instance. (To obtain peaking at these different distances the capacitor across the probe coil had to be varied.) The deviations of the three sets of points from curve 1 are probably within the limits of reproducibility of the readings. Curves 2 and 3 were obtained with distances of about 33 mils and 4 mils, respectively, of the probe coil from the surface. The peaking distance of the probe coil was about 18 mils, consequently, the probe coil was "off peak" for these measurements. The divergence of curves 2 and 3 from curve 1 demonstrates the importance of having the gage in the same state as when the calibration was made. The high sensitivity of curve 3 for coatings about 0.1 mil thick is noteworthy.

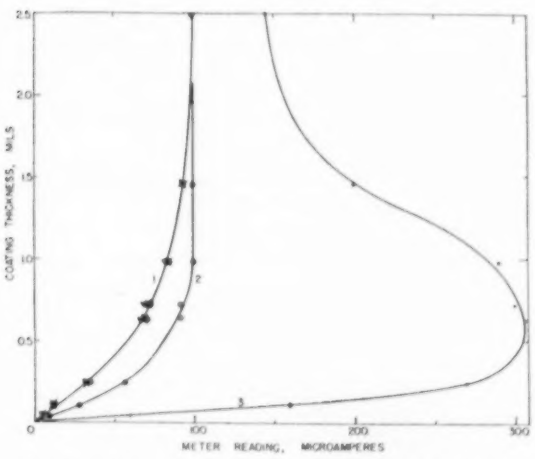


Fig. 7.—Effect of peaking and of the distance of the probe coil from the basis metal on calibration curves. Silver coatings plated on nickel silver. Dermitron operated at 2 Mc. Meter set to read zero on nickel silver and 100 on pure silver sheet.
Curve 1.—△ Probe coil peaked on nickel silver at a distance of about 4 mils. ○ Probe coil peaked on nickel silver at a distance of about 18 mils. × Probe peaked on nickel silver at a distance of about 33 mils.
Curve 2.—Readings taken with probe coil at a distance of about 33 mils from the metallic surface.
Curve 3.—Readings taken with probe coil at a distance of about 4 mils from the metallic surface.
Note: The probe coil used for curves 2 and 3 had a peaking distance of 18 mils.

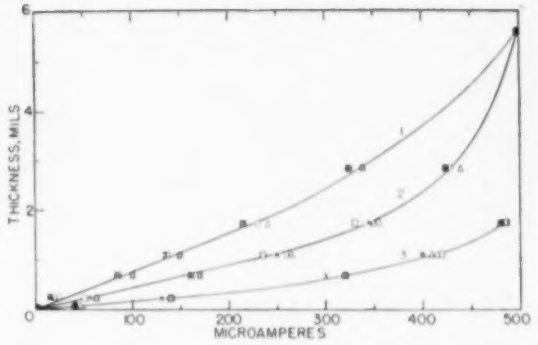


Fig. 8.—Calibration curves of silver on nickel silver made with four different Dermitron gages. ○, •, △, and □ designate the readings of four different Dermitrons. Curves 1, 2, and 3 were obtained with frequencies of 0.1 Mc, 0.5 Mc and 2.0 Mc, respectively. The gage was set to read zero on nickel silver and set to read 500 μa on the thickest silver coated standard. Curve 3 ascends vertically within ±10 μa for coatings thicker than about 3 mils.

Comparison of Calibrations Made with Different Gages.

Each combination of coating and basis metal requires a separate set of thickness standards for use in calibrating the Dermitron. For example, the calibration curve for silver coatings on nickel silver differs from that for silver coatings on yellow brass. In this respect, the Dermitron gage may seem less convenient than the magnetic type of thickness gage such as the Magne-gage which requires only one calibration for all nonmagnetic coatings on a steel base. However, a comparison of the labor involved in the calibration of the two types of gages is not as one-sided as first appears. If the calibrations for a given combination of basis metal and coating were the same for all Dermitron gages, only one would be necessary. This situation would actually make the calibration of the Dermitron gage simpler than that of the magnetic type of gages, such as the Magne-gage which incorporate permanent magnets, because each of the magnetic instruments must be individually calibrated.

A comparison was made of the calibrations of four experimental Dermitron gages. Three of the gages were of similar construction. One was a prototype of the other three and had a different type of oscillator. Each of the gages was calibrated with two sets of specimens: silver coatings on nickel silver, and copper coatings on steel. The calibration curves shown in Figs. 8 and 9 represent the best curves drawn through the four sets of points, each set corresponding to one of the Dermitrons. The deviation of the readings of the four gages from the curves was generally less than 10 per cent. This precision is usually satisfactory for the measurement of the thickness of plated coatings. If the construction of the gages were more rigidly standardized, as would be the case in commercial manufacture, better agreement of the readings would be expected.

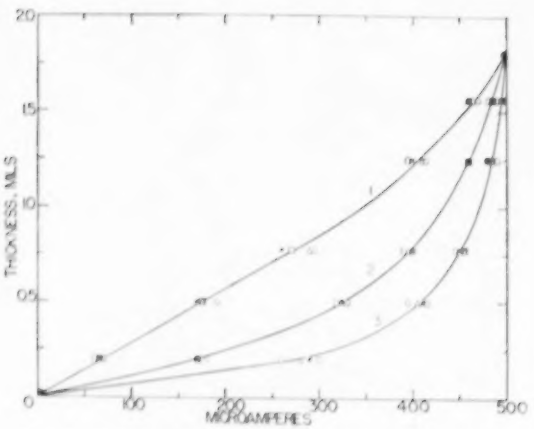


Fig. 9. Calibration curves of copper on steel made with four different Dermitron gages. ○, •, △, and □ designate readings of four different Dermitrons. Curves 1, 2, and 3 were obtained with frequencies of 0.1 Mc, 0.5 Mc and 2.0 Mc, respectively. The gage was set to read zero on steel and set to read 500 μa on the thickest copper coated standard.

Calibration curves for most combinations of coatings and basis metals can be prepared as indicated in Section II. A few calibrations require special discussion and are treated in the following sections.

Nickel Coatings.

The measurement of the thickness of nickel coatings is particularly important since more nickel is electroplated than any other metal. The only currently available nondestructive method of measuring the thickness of nickel coatings is based on the magnetic properties of nickel. The magnetic types of gages which have been devised for measuring the thickness of nonmagnetic coatings on steel may also be used for measuring the thickness of nickel coatings on steel or on a nonmagnetic basis metal, but only a few of them have the requisite sensitivity for the purpose.

The application of the Dermitron gage to the measurement of the thickness of nickel coatings on both magnetic and non-magnetic basis metals was studied. Although the Dermitron was more sensitive than the magnetic type of gage for indicating the thickness of nickel coatings, it was in general somewhat erratic, and consequently it cannot be recommended for this purpose except under restricted conditions.

The Dermitron had low accuracy in measuring the thickness of nickel coatings because the latter varied too much in physical properties. The wide variations in readings obtained with the Dermitron on several different types of electrodeposited nickel coatings about 10 mils thick are illustrated in Table I. Thick coatings were chosen, because at the frequencies used the Dermitron gives a constant reading on coatings more than several mils thick. The variations in readings in column 4 are too large to permit a calibration for one type of nickel coating to be used for measuring other types of nickel coatings.

The Dermitron might be used for measuring the thickness of a given type of nickel if the physical properties of the deposits were sufficiently reproducible. This possibility was investigated by taking readings on nickel coatings deposited on steel (Fig. 10) and brass (Fig. 11) from a Watts type of bath. These specimens had been collected over a period of about 10 years. The small black dots in Figure 10 represent specimens selected at random. Curve 1 was drawn for one particular set of specimens which were produced from a single bath, probably within a period of days or weeks, and is not intended to represent the average of all the points in the Figure. Curve 1 is unusual in that with increasing thickness of coatings the readings first increase, reach a maximum, and then decrease. This peculiarity militates against the use of the Dermitron if readings of an unknown specimen fell within the region where the curve turns back toward the left. The points for the various specimens of Figure 10 have a considerable scatter, and the error of measuring the thickness of a Watts nickel coating appears to be about 0.2 mil for coatings less than 1 mil thick.

In Fig. 11 the scatter of the readings for nickel coatings plated on brass at various times (all points in the Figure being considered) is even greater than for the nickel coatings on steel. The coatings on brass had been heat treated at 400 C for one hour. In this graph, a curve has been drawn for each set of specimens which presumably was plated at about the same time. These curves show that

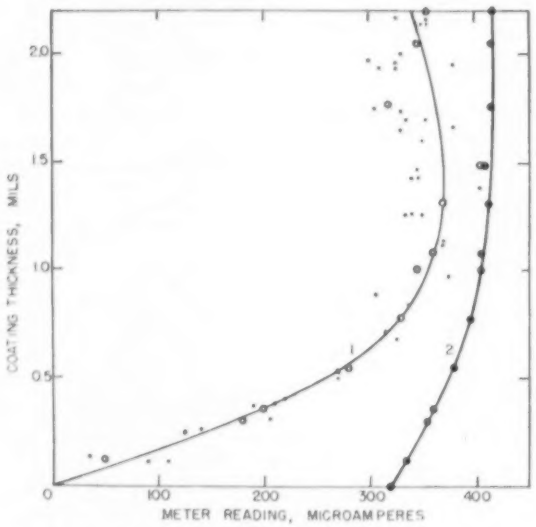


Fig. 10. Calibration curve at 2 Mc for nickel coatings on steel. Probe coil peaked on nickel. Instrument set to read zero on steel and 350 microamperes on a thick specimen of Watts nickel. All coatings were plated from a Watts type of bath. •, represents specimens selected at random from specimens produced over a period of ten years. ○, curve 1, represents a particular set of specimens all of which were prepared within a shorter interval of time, probably within a few days or weeks. ⊙, curve 2, represents readings obtained with the specimens of curve 1 placed across the poles of a horseshoe magnet.

a calibration curve might be used for plant control over a period of a few days or weeks, but not indefinitely. The readings obtained on the coatings 0.1 mil thick were low, and hence the curves do not aim at the origin. This may be the result of the interdiffusion of copper and nickel during the heat treatment.

The divergence in the readings of the Dermitron on various types of nickel coatings may be caused either by variations in the conductivity or in the magnetic properties of the deposits. However, a study [2] of the properties of nickel deposits had shown that the conductivity of nickel coatings did not vary greatly and therefore the magnetic properties are probably the important factor.

In contrast to the Dermitron, the permanent magnet type of thickness gage does not give a scatter in the readings on various specimens of nickel coatings plated on steel. However, measurements of nickel coatings on nonmagnetic basis metals with the magnetic instrument showed a scatter similar to that obtained with the Dermitron. Annealing of the nickel coatings at 400 C for an hour reduced the variability of the readings with the magnetic thickness gage, but did not appreciably reduce the scatter of the readings obtained with the Dermitron. This is shown in Fig. 11 which represents data for annealed specimens.

We attribute the variations in the magnetic properties of nickel mainly to the following two causes:

(1) Inclusions in the deposit and grain size.

(2) Stress in the deposit.

Annealing relieves stress in the deposit and this is probably the reason for the improvement in the reproducibility of measurements made with the magnetic type of thickness gage. The effect on Dermitron readings of differences in the magnetic properties due to (1) might be reduced by magnetically saturating the coating as this would render the magnetic permeability of the coating less important relative to the resistivity in determining the skin effect.

The effect of a magnetic field on the readings of the Dermitron was explored by placing specimens in the form of flat strips across the poles of a horseshoe magnet. The probe coil was applied to the specimen midway between the two poles. The coatings were probably not magnetically saturated, but the results should indicate the value of this approach. The last column of Table I shows that the presence of the magnetic field brought the readings on various nickel specimens closer together, but not sufficiently to make the method accurate. Measurements on nickel plated steel specimens in a magnetic field are represented by curve 2 in Fig. 10. An advantage was gained here since the calibration curve does not bend back toward the left. However, other data for nickel coatings on both steel and brass showed that the magnetic field did not sufficiently reduce the scatter of the readings.

Since stress affects the magnetic properties of nickel, the effect of stress in nickel on the readings with the Dermitron was investigated further. The procedure involved placing a strip of electrolytic nickel, about 0.01 inch thick, between the grips of a tensile testing machine and taking readings on the metal while under different loads. Two sets of

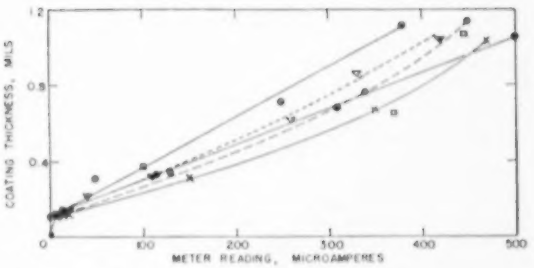


Fig. 11. Calibration curves at 2 Mc for nickel coatings deposited on brass. Probe coil peaked on nickel. Gage set to read zero on brass and set to read 500 microamperes on a thick specimen of Watts nickel. The nickel coatings were plated from a Watts type of bath and were collected over a period of ten years. All deposits were annealed at 400 C for one hour. ○, ◎, ●, △ and □ represent sets of nickel-plated brass standards. Each set was probably plated in one bath and the specimens were collected over a short interval of time, usually within a few days or weeks. A curve could not be drawn through the set of points designated by □. The broken lines are for the purpose of making the 5 curves more readily distinguishable.

readings were taken; one in the normal manner and one with the poles of a horseshoe magnet placed across the specimen. Data are given in Fig. 12 for a Watts nickel deposit and a bright nickel deposit containing about 1 per cent of cobalt. The curves show that stress has a large effect on the Dermitron readings. The magnetic field did not overcome the effects of stress and did not aid in obtaining more uniform readings. A similar experiment with copper instead of nickel showed virtually no effect of stress on the readings of the Dermitron.

Since Dermitron readings on magnetic materials are affected both by stress and by the presence of a magnetic field, with a suitable calibration it might be possible to measure either the stress or the magnetic flux in nickel or steel.

VII. NONCONDUCTIVE COATINGS ON A METALLIC BASE

In the previous discussion, emphasis was placed on the importance of peaking to improve reproducibility of measurements. In measuring the thickness of nonconductors on a metallic base, a lessening of the effects of inclination of probe and surface curvature would also be desirable. However, peaking cannot be applied to measurements of the thickness of a nonconductor on a metallic base because these measurements are equivalent to measuring the distance of the probe coil from a metallic surface. Consequently, the probe coil cannot be maintained at the peaking distance.

The probe coil should not even be set at the peaking distance when measuring nonconducting coatings, because as Fig. 6 shows, the Dermitron readings are least sensitive to distance when the probe coil is peaked. To avoid these difficulties it is preferable to make measurements of the thickness of nonconductors with the distance of the probe coil to the basis metal less than the peaking distance.

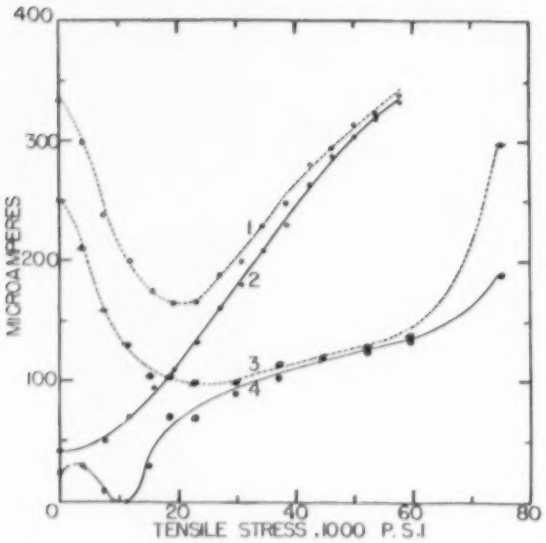


Fig. 12.—Effect of tensile stress in nickel on readings of Dermitron gage. Curves 1 and 2 represent data for Watts type of nickel. Curves 3 and 4 represent data for a bright nickel containing 1 per cent of cobalt. The dotted curves are for readings taken with the specimen in a magnetic field, and the solid curves are for readings taken without a magnetic field.

This means that the peaking distance of the probe coil must be greater than the range of thickness measured.

Fig. 13 shows three groups of calibration curves for the thickness of nonconducting coatings on copper, brass, and steel. The curves were drawn toward the origin, but the shape of the curve was not investigated near the origin. The three groups of curves (1, 2, and 3) differ in that the probe coil was set at different distances from the uncoated basis metal when making the zero setting of the calibration. The spacing of the probe coil from the basis metal was accomplished by adjusting the protrusion of the sapphire rod beyond the end of the probe coil. When the probe coil was placed on a coated specimen, the distance of the probe coil from the basis metal was increased by an amount equal to the thickness of the coating. The sapphire rod protruded 5 mils for curves 1 and 2 and 20 mils for curve 3. A further difference in the three groups is that for groups 2 and 3 the initial distances of 5 mils and 20 mils, respectively, were also the peaking distance of the probe coil on copper. In group 1 the peaking distance of the probe coil on copper was 20 mils. However, the probe was used with the sapphire rod protruding only 5 mils. Consequently, in making the calibration curves 1-Cu and 1-B the distance of the probe coil from the metals was always less than the peaking distance. In making the calibration curves Cu and B of groups 2 and 3, the zero setting of the meter was made with the probe coil peaked on uncoated metal. Consequently, on the coated specimens the distance of the probe coil from the metals was always greater than the peaking distance.

The curves in Figure 13 show that the measurements (Group 1) were most sensitive with the probe coil closer to the basis metal than the peaking distance and least sensitive (Group 3) with the probe coil peaked and at a relatively great distance from the basis metal. Since the measurements of group 1 were made with the probe coil always closer to the basis metal than the peaking distance, these calibration curves correspond to those parts of the curves of Figure 6 which are to the left of the minima. Similarly, since the measurements of groups 2 and 3 were accomplished with the probe coil farther from the basis metals than the peaking distance, these calibration curves correspond to the part of the curves of Fig. 6 to the right of the minima.

Since the curves of group 1 correspond to the left side and the curves of groups 2 and 3 to the right side of the minima in Fig. 6, the slope of group 1 should be opposite in sign to the slopes of the curves of groups 2 and 3. That is, the readings of one group should increase with thickness and those of the other decrease. Since the meter of the Dermitron is provided with a reversing switch, all readings actually increased with thickness. The representation of all the curves with a positive slope is an advantage since it makes the comparison of the slopes more convenient.

In summation, the measurement of the thickness of non-conductors on metallic bases presents a dilemma, because the conditions that give the greatest sensitivity, namely, the probe close to the surface and off-peak, also make the measurements more subject to errors from the inclination of the probe and curvature of the specimen. Therefore, if possible, a compromise should be adopted with the probe set as near to peak as is practicable to yield a sufficient sensitivity.

The gage heads provided with a micrometer screw as

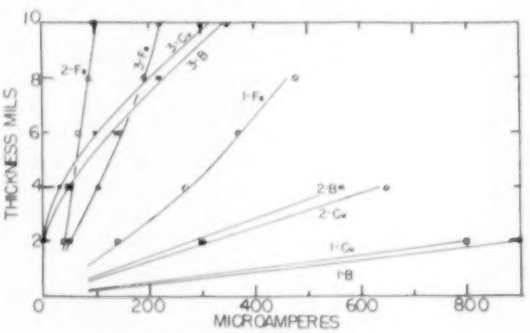


Fig. 13.—Calibration curves of the Dermitron for the measurement of the thickness of nonconductive coatings on a metallic base. The meter was set to read zero with the gage head placed on the uncoated basis metal. Cu, B, and Fe refer to basis metals of copper, brass and steel, respectively. 1-Cu, 1-B, and 1-Fe. Calibrations made with the sapphire rod of the probe coil protruding about 5 mils. (Peaking distance of probe coil on copper was 20 mils.) 2-Cu, 2-B, and 2-Fe. Calibrations made with the probe coil initially peaked on copper at a distance of about 5 mils. Protrusion of sapphire rod about the same as for curves 1. 3-Cu, 3-B, and 3-Fe. Calibrations made with the probe coil initially peaked at 20 mils from copper basis metal. Protrusion of sapphire rod was also 20 mils.

shown in Figs. 2 and 4 can be used for measuring the thickness of nonconductors on metals without a calibration curve. The procedure consists of first placing the gage head on the bare metal and taking a reading on the microammeter. The reading on the micrometer head is also noted. The gage head is next placed on the coated specimen and the micrometer screw adjusted until the initial reading of the meter is duplicated. The thickness of the nonconducting coating is given by the difference in the two micrometer readings.

VIII. COATINGS OF POOR METALLIC CONDUCTORS ON GOOD CONDUCTORS

The measurement of the thickness of a poorly conductive coating on a good conductor, is not as sensitive as the measurement of the reverse combination. Since the depth of penetration of the eddy current is greater the poorer the conductivity of a metal, a large proportion of the magnetic field penetrates the poor conductor and sets up the eddy current within the better conducting basis metal. Thus, the presence of the poorly conductive metal coating has much less effect on the eddy current than an equal thickness of a highly conductive coating. The sensitivity of the measurement of the thickness of a poorly conductive coating on a good conductor should fall between the extremes of the measurements of highly conductive coatings on a poorly conductive basis metal and of nonconductors on a metallic base.

Lead coatings on copper may be considered as a typical example of a poorly conductive coating on a highly conductive metal. For reliable measurements at a frequency of 2 Mc, coatings must be at least several tenths of a mil thick. In contrast, coatings of copper several hundredths of a mil thick on lead can be detected.

The sensitivity in measuring the thickness of poorly conductive coatings can be increased (1) by operating the probe coil off peak and (2) by employing a higher frequency. However, method (1) brings with it the usual difficulty that inclination of the gage head causes large errors. The best solution of the difficulty is (2) so that a large proportion of the eddy current flows in the coating. It is likely that a frequency of 10 or 20 Mc would give a sensitivity of measurement of lead on copper comparable to that obtained with copper on lead at 2 Mc.

IX. CONCLUSIONS

(1) In the thickness gage, a bridge circuit is preferable to a branch circuit.

(2) The peaking distance depends on the electrical constants of the circuit, the curvature of the surface, and the type of basis metal.

(3) Measurements with the gage should be made with the probe coil at the peaking distance from the specimen.

(4) The calibration curves of four different Dermitrons were similar.

(5) The thickness of nickel coatings selected at random, cannot be accurately measured and the Dermitron gage is not recommended except under restricted conditions.

(6) Measurements of the thickness of nonconducting coatings on a metallic basis metal preferably should be done with the probe coil off peak.

X. ACKNOWLEDGMENT

The authors acknowledge the assistance of Oscar Hurst in the design of the gage head shown in Fig. 5 and also acknowledge the contributions of Garcia-Rivera in the initial stages of this study.

REFERENCES

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[2]V. Zentner, A. Brenner, and C. W. Jennings, Plating **39**, 865 (1952).

TABLE I

Effect of Magnetic Field on Readings Taken with the Dermitron at 2 Mc on Electrodeposited Nickel Sheet, 0.01 Inch Thick

All deposits plated at 5 amp/dm² Dermitron Set to Read Zero on Steel

Type of Deposit	Temp. of Deposition	pH	Without Magnet Microampere	With Magnet Microampere
Watts	80	3	85	100
Watts	55	5	77	95
Watts	80	1.5	86	102
Fluoborate	55	4.5	84	100
Chloride Acetate	50	4.5	104	134
Cobalt Bright Nickel	65	2.3	92	102
Organic Bright Nickel	55	3.5	45	100
			82 ± 12	105 ± 9

Dr. Abner Brenner received a BA degree in 1929 from the University of Missouri, MS degree from the University of Wisconsin 1940 and PhD degree from the University of Maryland in 1939. He has been on the staff of the National Bureau of Standards since 1930 and is Chief of the Electrodeposition Section. Brenner has twice received the Proctor Award of the AES and has also received the Department of Commerce Award for Meritorious Service. He is a member of the ACS, AES, Electrodepositors Technical Society, Electrochemical Society, Washington Association of Scientists, Phi Beta Kappa and Sigma Xi.

Frederick P. Brodell graduated in 1940 from the University of Michigan with a BS degree in Metallurgy, and was employed in various government agencies for a total of fourteen years as an instructor in Metallurgy, U. S. Naval Academy; Metallurgist, U. S. Naval Gun Factory, Washington and Metallurgist with the National Bureau of Standards. At present, Mr. Brodell is a Metallurgist in the Material and Process Group at Convair, San Diego. His experience has been in the metallographic laboratory, studying the properties of metals and alloys and diagnosing failures of fabricated parts.

THE POLAROGRAPHIC ANALYSIS OF TIN AND TIN ALLOY PLATING SOLUTIONS

by A. E. KNOTOWICZ and J. V. PETROCELLI†

INTRODUCTION

THE WORK REPORTED in this communication is a part of the general study undertaken in the authors' laboratory to develop polarographic methods of analysis for the control of plating solutions.[1] Polarographic methods are generally more rapid than classical techniques, their precision and sensitivity compare favorably with other microanalytical methods, and polarography ranks among the three or four most widely used techniques of instrumental analysis.

Methods published to date, for the polarographic determination of copper,[2] zinc,[2, 3, 5] and cadmium,[4, 5] in plating solutions, involve a digestion with acid; and a method for tin,[5] using a perchloric acid-sodium chloride supporting electrolyte, does not consider the possible interference of copper and cadmium with the tin wave.

Therefore, the object of this study was to determine a method for the polarographic analysis of tin and the elements commonly alloyed with tin in plating solutions, eliminating a digestion with acid where possible.

†The Patent Button Company, Waterbury, Connecticut.

EXPERIMENTAL

Apparatus and Materials

A Patwin electro-polarizer Model R-1* was used with a Patwin polarographic cell and a saturated calomel reference electrode. The capillary constant was 1.830 $mg^{2/3}$ $sec^{-1/2}$ in 0.1 N KNO_3, 16 per cent mannitol. All experimental data was obtained with this capillary and constant.[1]

EXPLORATORY EXPERIMENTS

Several supporting electrolytes were tried for the de-

* Patwin Electro-Polarizer, Model R-1, manufactured by Patwin Instruments Division, The Patent Button Company, Waterbury, Connecticut.

TABLE I

POLAROGRAPHIC CHARACTERISTICS OF TIN, ZINC, CADMIUM, AND COPPER IN VARIOUS SUPPORTING ELECTROLYTES

Half-wave potentials in volts vs the saturated calomel electrode

In all cases, unless otherwise noted, 0.004 per cent gelatin was present as a maxima suppressor, and the data is for 0.25 ml of plating solution diluted to 50 ml with supporting electrolyte.

	2M NaOH	4M NH_4Cl 1M HCl	6.8N $CaCl_2$ 1.0N HCl 0.012% gelatin	1M KCN	1M NH_4OH 0.5 M$(NH_4)_2SO_4$
Sn^{IV}	N.R.	−0.25	−0.35	N.R.	N.R.
Sn^{II}	−1.12	−0.52	−0.61	−1.05	N.R.
Cu^{II}	N.R.	−0.18	−0.20	N.R.	−0.24*
Cu^{I}	N.R.	−0.35	−0.40	N.R.	−0.48*
Cd^{II}	−0.76	−0.78	−0.80	−1.18	−0.85
Zn^{II}	−1.53	N.R.	N.R.	N.R.	−1.42

* Plating solution first digested with nitric and sulfuric acids.

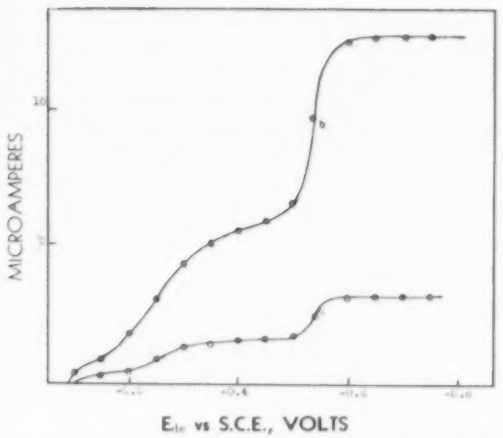

Fig. 1. Polarograms of stannic tin in 4M NH_4Cl and 1M HCl, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.0002M Sn^{IV} (b) 0.0008M Sn^{IV}

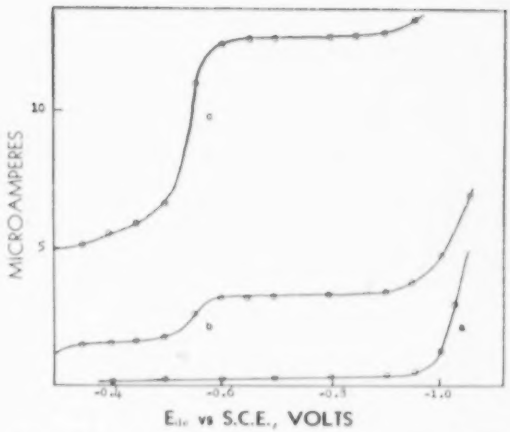

Fig. 3. Polarograms of stannic tin and zinc in 4M NH_4Cl and 1M HCl, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.0018 M Zn^{II} (b) 0.0002 M Sn^{IV} (c) 0.0008 M Sn^{IV}

termination of tin and the other alloying constituents of tin-alloy plating solutions. The values of the half-wave potentials are shown in Table I.

TIN

Stannic tin gives a well developed reduction wave in acid chloride medium.[7] Lingane[8] found that an optimum supporting electrolyte was 4M ammonium chloride and 1M hydrochloric acid, with 0.005 per cent gelatin as a maxima suppressor. Experiments with 6.8N calcium chloride and 1N hydrochloric acid, with 0.012 per cent gelatin as a maxima suppressor, substantiated the fact that the stannic reduction wave is quantitative when the concentration of chloride ion is five molar or more. Typical reduction waves are shown in Fig. 1 and Fig. 2.

ZINC

Zinc does not give a reduction wave in the acid chloride medium used for the determination of stannic tin. On the other hand, stannic tin does not give a reduction wave in sodium hydroxide supporting electrolyte.[7] And, although stannous tin does give both an oxidation and a reduction wave in the sodium hydroxide medium, its presence in the plating solution is negligible, and its half-wave potential is several tenths of a volt more electropositive than that of zinc.

In 2M sodium hydroxide, with 0.004 per cent gelatin as a maxima suppressor, zinc gives a well developed reduction wave, which is quantitative with concentrations of 0.0001 to 0.004 moles of zinc in the polarographic cell. Typical waves are shown in Fig. 3 and Fig. 4.

CADMIUM

Although cadmium gives a reduction wave in the acid chloride medium used for the determination of stannic tin, the half-wave potential of cadmium is more electro-

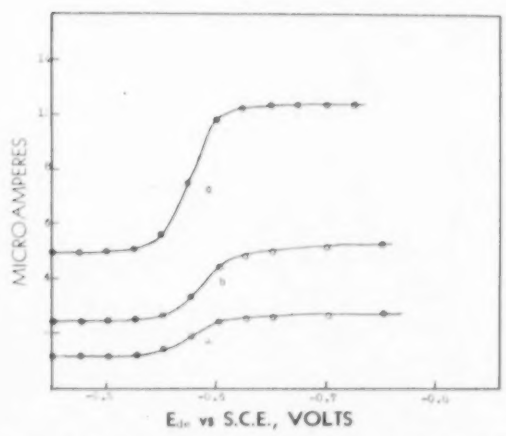

Fig. 2. Polarograms of stannic tin in 6.8N $CaCl_2$ and 1N HCl, with 0.012 per cent gelatin present as a maxima suppressor. (a) 0.00035 M Sn^{IV} (b) 0.0007 M Sn^{IV} (c) 0.0014 M Sn^{IV}

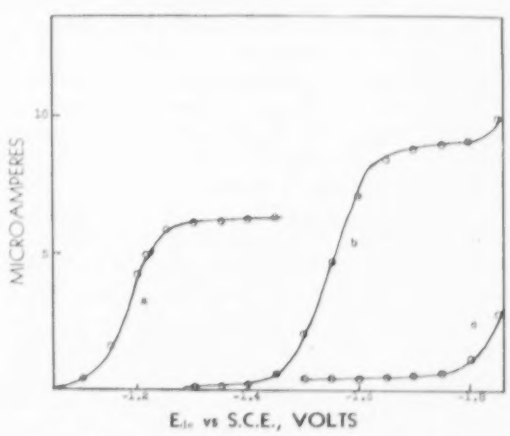

Fig. 4. Polarograms of stannous and stannic tin, and zinc in 2M NaOH, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.002 M Sn^{II} (b) 0.0018 M Zn^{II} (c) 0.0014 M Sn^{IV}

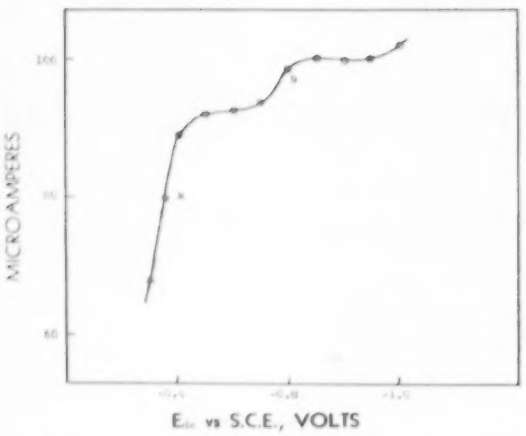

Fig. 5. Polarograms of stannic tin and cadmium in 4M NH_4Cl and 1M HCl, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.008 M Sn^{IV} (b) 0.0011 M Cd^{II}

negative than that of stannic tin by 0.26 volts, and cadmium will not interfere. However, this method does not lend itself to the determination of both cadmium and stannic tin because the ratio of cadmium to tin is small in the average plating solution.

On the other hand, cadmium does give a well developed reduction wave in 2M sodium hydroxide, with 0.004 per cent gelatin as a maxima suppressor. Stannic tin shows no reduction wave in this medium; and stannous tin, although giving a reduction wave, will not interfere as it is not present in appreciable quantities in the plating solution. Typical waves are shown in Fig. 5 and Fig. 6.

COPPER

Copper gives a well developed reduction wave in the ammonium chloride-hydrochloric acid medium used for the determination of stannic tin. In the presence of stannic tin, however, both the cuprous and the cupric wave merge with the first tin wave ($Sn^{IV} \rightarrow Sn^{II}$). And, although it has been recommended that the second tin wave be used for practical analysis,[7] it cannot be used for the analysis of tin in the presence of appreciable amounts of copper, as the slope of the plateau of the combined wave (cupric, cuprous and stannic waves) varies with the ratio of copper to tin. Typical curves are shown in Fig. 7.

The slope of the combined copper and tin wave, however, does approach zero as the chloride concentration is increased, the copper and tin ratio remaining fixed. With a supporting electrolyte of 6.8N calcium chloride and 1N hydrochloric acid, with 0.012 per cent gelatin as a maxima suppressor, a well developed second tin wave ($Sn^{II} \rightarrow Sn^{0}$) was observed for concentrations of 0.0003 to 0.003 moles of copper when the tin concentration was varied from 0.0003 to 0.003 moles of tin. (A dilution of 0.25 ml of plating solution to 50 ml will bring most copper-tin plating solutions into this range.) Typical curves are shown in Fig. 8.

The calcium chloride-hydrochloric acid supporting electrolyte, however, cannot be used for the determination of copper by difference, because the cupric wave develops and increases upon standing. Therefore, for the determination of copper, tin is first precipitated as meta-stannic acid with concentrated nitric and sulfuric acids, and the copper is then determined in ammonium hydroxide-ammonium chloride supporting electrolyte.[1] (Cadmium and zinc may be determined in this same manner.) Typical reduction waves for copper are shown in Fig. 9.

ANALYTICAL METHODS

As a result of this study, the following methods have been developed for the determination of tin and some of the alloying constituents in tin-alloy plating solutions.

ALKALINE STANNATE BATH

Total Tin

Pipette a 0.25 ml sample of a 14 oz/gal bath* into a 50 ml volumetric flask, add 1 ml of 0.2 per cent gelatin solution, and dilute to the mark with supporting electrolyte (4M ammonium chloride and 1M hydrochloric acid).

Deaerate with nitrogen.

Read the diffusion current at −0.700 volts.

TIN-ZINC ALLOY BATH

Total Tin

Total tin is determined as in alkaline stannate bath.

Zinc

Pipette a 1 ml sample into a 50 ml volumetric flask, add 1 ml of 0.2 per cent gelatin solution, and dilute to the mark with supporting electrolyte (2M sodium hydroxide).

Deaerate with nitrogen.

* For 28 oz/gal and 56 oz/gal baths, the plating solution should be diluted into the range of 14 oz/gal, otherwise the diffusion current values will be abnormally high.

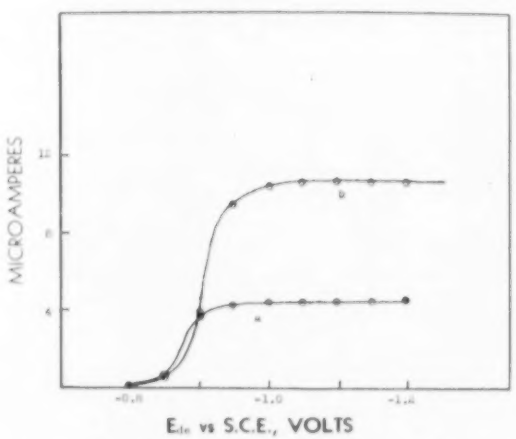

Fig. 6. Polarograms of cadmium in 2M NaOH, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.00078 M Cd^{II} (b) 0.0019 M Cd^{II}

Read the diffusion current as the difference between the current at −1.800 and −1.300 volts.

TIN-CADMIUM ALLOY BATH

Total Tin

Total tin is determined as in alkaline stannate bath.

Cadmium

Pipette a 3 ml sample into a 50 ml volumetric flash, add 1 ml of 0.2 per cent gelatin solution, and dilute to the mark with supporting electrolyte (2M sodium hydroxide).

Deaerate with nitrogen.

Read the diffusion current as the difference between the current at −1.200 volts and the current at −0.700 volts.

TIN-COPPER ALLOY BATH

Total Tin

Pipette a 0.25 ml sample into a 50 ml volumetric flask, add 3 ml of 0.2 per cent gelatin solution, and dilute to the mark with supporting electrolyte (6.8N calcium chloride and 1N hydrochloric acid).

Deaerate with nitrogen.

Read the diffusion current as the difference between the current at −0.700 volts and the current at −0.475 volts.

Copper

Pipette a 0.25 ml sample into a 50 ml volumetric flask, add 0.5 ml of concentrated nitric acid and 0.5 ml of concentrated sulfuric acid, and digest to sulfur trioxide fumes. Cool. Add 1 ml of 0.2 per cent gelatin solution, and dilute to the mark with supporting electrolyte (1M ammonium hydroxide and 1M ammonium chloride).

Deaerate with nitrogen.

Read the diffusion current as the difference between the current at −0.700 volts and the current at −0.350 volts.

A comparison of results obtained polarographically and chemically is shown in Table II.

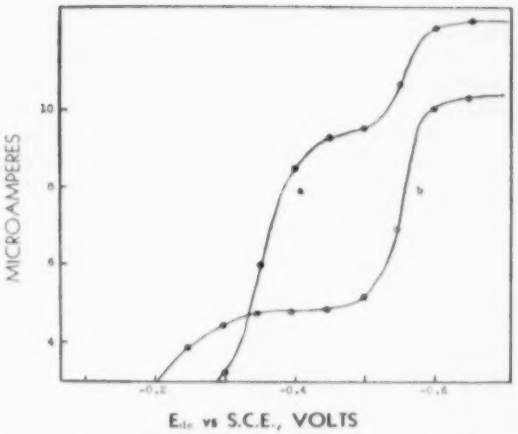

Fig. 8. Polarograms of stannic tin and copper in 6.8N $CaCl_2$ and 1N HCl, with 0.012 per cent gelatin present as a maxima suppressor. (a) 0.0007 M Sn^{IV} and 0.0027 M Cu^{I} (b) 0.0014 M Sn^{IV}

TABLE II

COMPARISON OF POLAROGRAPHIC AND CHEMICAL RESULTS

Bath*		Chemical** (oz/gal)	Polarographic (oz/gal)
Alkaline Stannate	Sn^{IV}	9.59	9.63
Tin-Zinc Alloy	Sn^{IV}	5.92	6.08
	Zn^{II}	1.09	1.09
Tin-Cadmium Alloy	Sn^{IV}	1.47	1.43
	Cd^{II}	0.37	0.39
Tin-Copper Alloy	Sn^{IV}	1.59	1.60
	Cu^{II}	2.72	2.67

* Plating solutions as supplied by Metal and Thermit Corp.
** Chemical analysis by Metal and Thermit Corp.

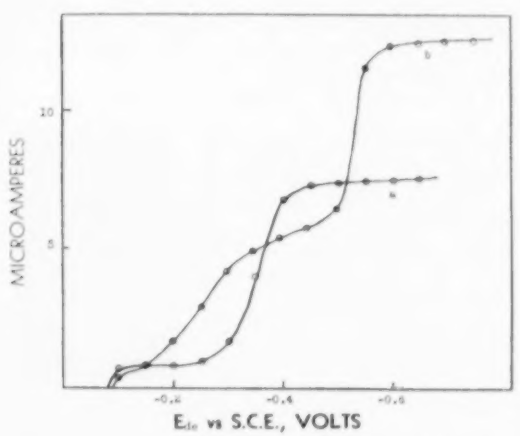

Fig. 7. Polarograms of stannic tin and copper in 4M NH_4Cl and 1M HCl, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.0027 M Cu^{I} (b) 0.0008 M Sn^{IV}

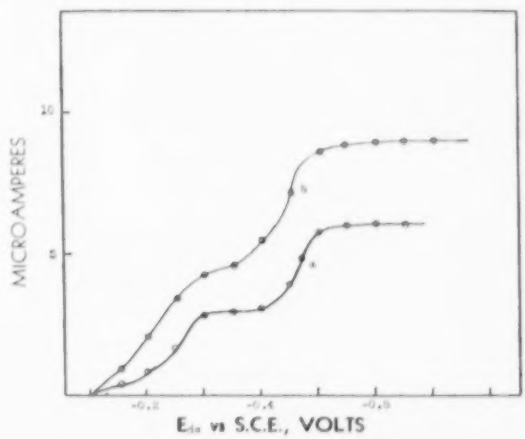

Fig. 9. Polarograms of copper in 1M NH_4OH and 1M NH_4Cl, with 0.004 per cent gelatin present as a maxima suppressor. (a) 0.0009 M Cu^{II} (b) 0.0014 M Cu^{II}

CALIBRATION CURVES

A calibration curve for each of the preceding methods of analysis may be prepared from synthetic plating solutions. The synthetic plating solution is prepared so that its concentration is higher than the maximum concentration of metal which can be normally expected in the particular plating bath. Three dilutions of this solution are

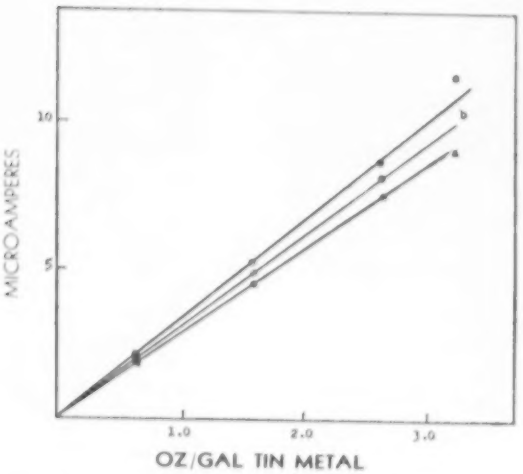

Fig. 10. Calibration curve for total tin in alkaline stannate bath. (a) Temp 20 C. (b) Temp 25 C. (c) Temp 30 C.

then made so that the resultant solutions are representative of the concentration range of the plating bath. (Concentration range of the plating bath can be determined from records of previous chemical analysis.) The undiluted sample and the three diluted samples are then analyzed polarographically, and the diffusion current recorded. The diffusion current is now plotted against the concentration of each sample. During the analysis of an unknown, the conditions under which the calibration curve was obtained must be kept the same, that is, the temperature, capillary, height of the mercury column must be the same when a polarographic analysis is made as they were when the calibration curve was determined.

A typical calibration curve is shown in Fig. 10.

ACKNOWLEDGMENT

The authors wish to express their appreciation to George Tatoian of Patwin Instruments, and to Dr. F. A. Lowenheim of Metal and Thermit Corporation for their invaluable aid during the course of this work.

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The Patwin C-2 electro-polarizer.

A. E. Knotowicz is a graduate of Holy Cross College where he received a BS in Chemistry in 1948. He is a Research Engineer at The Patent Button Company, Waterbury, Connecticut. His duties include development of instrumental methods of analysis and instruments. Previously he gained experience in the electronic and electroplating fields, in both production and engineering capacities. Mr. Knotowicz is 31 years of age, married and the father of two children. He is a member of the Waterbury Branch, AES.

Dr. J. V. Petrocelli is Director of Research, The Patent Button Company, Waterbury, Connecticut, and received his BA and MA degrees from Wesleyan University and PhD from Yale University. He is past chairman of the Corrosion Division of the Electrochemical Society and past president of the Waterbury Branch of the American Electroplaters' Society. Active in research work in the fields of electrochemistry, particularly plating, corrosion and instrumentation, Dr. Petrocelli also has authored several papers on the mechanism of electrode processes. He is a member of the American Association for the Advancement of Science, the Electrochemical Society, American Chemical Society and the American Electroplaters' Society.

PRINTED CIRCUITS

AND THE ELECTROPLATING INDUSTRY

by Harold Shapiro*

UNTIL A FEW SHORT years ago, the biggest manpower waste in the electronic industry was the hand wiring and hand soldering of wires and component parts. In many complicated electrical systems this could account for 25 to 50 per cent of the fabrication time required for a radio or television set. Not only did the advent of printed circuitry cut production time, but it has also provided a uniform product of better quality and reliability. "Printed circuits" will, in the next five years, become household words for the industry.

A short time ago printed circuits were found mainly in military equipment and only a few companies were adapting them to military electronic assemblies, radio and television sets. Automation has developed hand-in-hand with printed circuits.

In a production line, because the cut and dry lines of the printed circuit are consistently the same, the automatic insertion of components is a logical step. The ease of assembly ultimately means reduced cost to the consumer. In military equipment, the ease of assembly assures a greater production potential in case of war, as well as a cost cut, important to all taxpayers. In the next few years it will be interesting to note that printed circuits will be activating the automatic washer, dryer, air conditioner, stove and even the electrical nerve centers in your car. Some of the new cars already are utilizing printed circuits. All this points to the tremendous potential of the use of printed circuitry.

Printed circuitry can best be explained in terms of evolution. The early less intricate circuits could be made by the simplest method of fabrication; the highly specialized circuits employed in complex electronic systems today are very exacting.

Basically, a printed circuit is an electrically conductive pattern usually of copper foil bonded to an insulator base. The methods used to achieve the final product are many and from all appearances in industry today they seem to be infinite in their ingenuity and in their quantity. There are numbers of variations in printing the pattern, etching, electroplating and bonding the metal to the base. Currently, circuits are produced by stamping, embossing and the most popular method, the photomechanical method commonly referred to as the "etching process."

Etching is a process which entails "destructive" building of the circuit rather than "constructive." In this process the copper in the unwanted areas is selectively etched away by acids. Etched foil circuitry is the type which interests the plating industry today, because it is most adaptable to plating techniques

In fabricating the printed circuit, it is usual to begin with a copper clad board, a phenolic laminate upon which a copper foil is glued under heat and pressure. A resist or stopoff is placed on the copper in predetermined selected pattern designs which will not conduct during the plating cycle. There are many ways to achieve this.

One of the most common is the photographic method. A light sensitive coating is sprayed over the copper surface, a positive, or a negative in reverse is then exposed on this area. The "picture" is subsequently developed. The result is a pattern design with a coating only in the areas where plating is not wanted. When large production is needed, the photographic method is too slow and costly. Offset printing and silk screening are more desirable. Silk screening is the most popular, because thicker layers of resist or stopoff are possible thereby preventing any plating in unwanted areas when high current densities are used. Silk screening is simply a fine mesh screen of fabric or metal in which holes are selectively stopped off, so that when heavy ink is squeegeed over the screen only those holes that are open allow the ink to be deposited on the copper laminate which is placed beneath. Sylvania has done considerable research on more economical chemicals for use in the photographic processes. This work on the newer types of cold top enamels not only has brought the price of the process down, but has made the method more reliable.

Another method for putting on the pattern requires the use of stainless steel stencils which clamp tightly over the copper foil, selectively preventing and allowing plating. Many plastics have been utilized in this particular method.

With the circuit pattern printed, the next step is electroplating. A popular type of plating used in the printed circuit industry today is 60/40 tin-lead from a fluoborate bath. This is used because it facilitates subsequent soldering operations. (Silver is also extensively utilized on special types of circuits where good electrical contact is needed.) After the circuit is plated with the solder, the resist or stopoff is removed and the unwanted copper is etched away leaving the desired pattern. When solder is used as the resist, the etchant is usually a mixture of chromic and sulfuric acids. Where asphaltum type resists are used, or photographic resists, the etchant can be a 40° to 42° Baumé ferric chloride solution. This process yields an unplated circuit, the type which is used exten-

*Electronic Systems Division, Sylvania Electric Products, Inc., Buffalo, New York.

METHODS OF CIRCUITRY FABRICATION

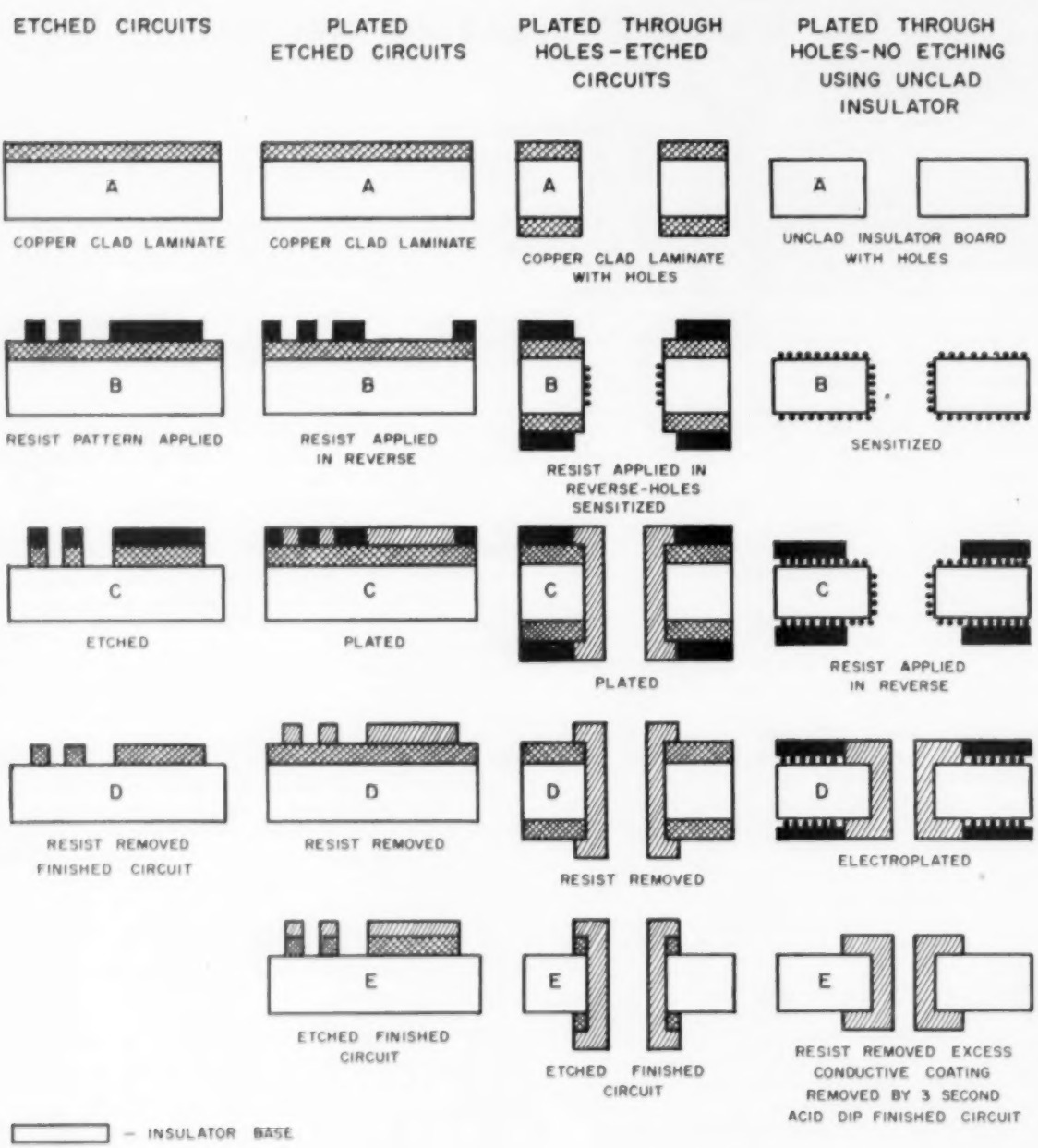

Fig. 1. Schematic diagram of the basic types of circuitry fabrication.

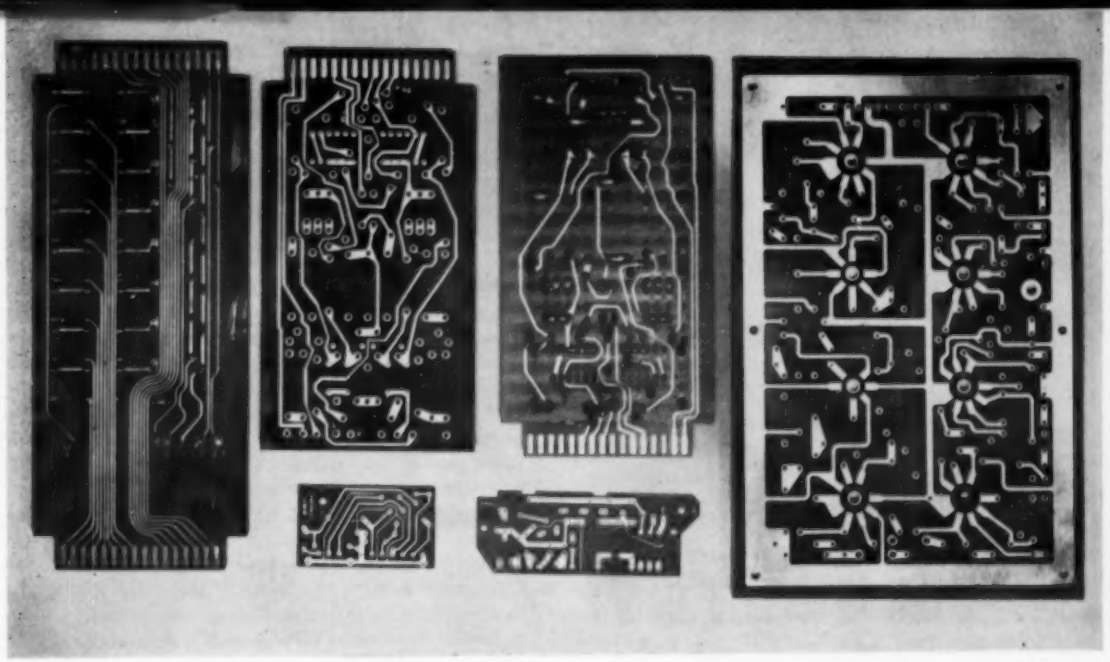

Fig. 2. Typical examples of printed circuit boards.

sively on commercial applications. Two important factors are to be considered. First, the resist must be unaffected by the plating bath. Second, the resultant plating must be unaffected by the etching bath. Here the choice of etchants becomes critical.

As some of the circuit base materials in use today are of the phenolic type the first problem that confronted Sylvania was the *p*H of the plating bath. Warm alkaline baths were injurious not only to the base material, but also in many cases attacked the adhesive bond. This was found to be true for high *p*H plating baths as well as for highly alkaline, immersion type plating processes. Heat also had an effect on the materials, so baths of moderate temperatures were employed. To offset these chemical and heat problems Sylvania in many cases now utilizes epoxy or silicone glass cloth laminates which are more resistant to extremes of *p*H and temperature, and the foil-to-plastic bond is made with a thermosetting epoxy adhesive rather than a thermoplastic adhesive, resulting in high temperature resistance.

Back in the days when printed circuitry was in its "alchemy" stages only one side of the insulator had a conductive pattern. The next step in the evolution chain was to utilize both sides of the board for even a greater saving in space. This resulted in an insulator board that had copper foil on both sides. Eyelets were used to make side to side connection. The use of eyelets was expensive and unreliable in military applications where the circuit had to withstand severe environmental tests. The rolled over eyelet made the necessary contact to the conductor but the big disadvantage was its inability to expand and contract at the same rate as the conductive pattern. This led to breaks in the solder joints and consequently poor connections. As a result a method had to be developed to eliminate the eyelets and still make good side-to-side connections. To accomplish this the holes themselves had to be made conductive for subsequent plating.

One of the earliest methods to be used was a silver reduction method in which an ammoniacal solution of silver nitrate is reduced to its metallic form by formaldehyde. This can also be accomplished by metal spray, a colloidal dispersion of silver in a lacquer type vehicle. The use of silver is an expensive method and the recovery of the silver from the blowby of the spray is costly whether the spray is a lacquer dispersion or a double orifice reduction spray. Not only is the expense of the process a factor, but the use of silver also found disfavor in the use of military and some commercial applications because of phenomena of silver ions migrating through the body of the insulating base causing leakage. This was found to occur under certain conditions of humidity and high D.C. potential this can short out a piece of electronic gear making an entire system unusable.

To eliminate these problems a new chemical reduction method has been developed for depositing a thin layer of conductive copper to prepare the holes for subsequent plating operations. The use of copper is much more economical than silver and eliminates the possibility of electrical leakage from silver ion migration.

In the plating of the printed circuit boards the copper fluoborate type of bath is used. This bath is favored over the cyanide bath as the adhesive bond is not attacked nor is the base material affected. It is favored over the acid copper sulfate as the surface is very receptive to subsequent solder plating. The breakdown of the copper fluoborate concentrate is as follows:

		% wt
Copper fluoborate	$Cu(BF_4)_2$	45.0
Copper, metallic equivalent	Cu	12.1
Fluoboric acid	HBF_4	2.0 to 3.0
Boric acid	H_3BO_3	2.5 to 3.0

The bath found most desirable is a 1:1 mixture of the concentrate with water. This would be an intermediate

Fig. 3. A small splash etching machine used in prototype work and small production runs.

metal concentration. In special applications higher concentrations can be used. The anodes used are of high purity electrolytic grade and are Dynel bagged. Current density for printed circuits varies from 25 to 75 amp/sq ft. Lower amperage is desirable in printed circuit work.

When solder plating the printed circuits, the tin-lead fluoborate bath is used. The breakdown is as follows:

Tin Fluoborate Concentrate:

		% wt
Stannous fluoborate	$Sn(BF_4)_2$	47
Tin	Sn	19
Fluoboric acid	HBF_4	4
Boric acid	H_3BO_3	3

Lead Fluoborate Concentrate:

		% wt
Lead fluoborate	$Pb(BF_4)_2$	50
Lead	Pb	27.2
Fluoboric acid	HBF_4	9.7
Boric acid	H_3BO_3	4

For best printed circuit solderability the 60 per cent tin and 40 per cent lead formulation is used. The following is a typical makeup for a 100 gallon bath used:

Stannous fluoborate (47%)	19.7 gallons
Lead fluoborate (50%)	5.3 gallons
Water	69.8 gallons
Fluoboric acid (48%)	5.2 gallons
Boric acid	10.3 pounds
Peptone	4.3 pounds

Plating Conditions

Temperature	16 to 38 C (60 to 100 F)
Current density	30–45 amp/sq ft
pH	0.5 or less (colorimetric)
Agitation	mild cathode
Anode composition	60% tin, 40% lead
Anode to cathode area	2:1
Filtration	As required

The tin content of the deposit will vary from about 50 to 51.8 per cent at 12 amp/sq ft to about 62 to 63.5 per cent at 50 to 55 amp/sq ft.

Adhesion is of prime importance in plating printed circuits. A high grade of peptone has been proven the best glue substitute.

In the solder plate bath the anodes used must be of the same alloy concentration as the bath formulation and should be of high grade virgin metals. The anodes are bagged with either Dynel, Dacron or Vinyon for the best results over extended periods of time. In both the copper bath and the solder plate bath the geometry of the setup is critical and depends upon the design of the circuits being plated. In the copper fluoborate bath, both cathode agitation and solution agitation is used. In the solder bath, just cathode agitation. In the plated through hole process extensive investigation was made into the proper anode-cathode distribution and the proper solution flow through the holes of the circuit boards which is necessary to carry the copper into the holes.

The entire process of plating is rigidly controlled by the chemistry laboratory. Baths are kept as close as possible to the original makeup concentrations. The control is rigid because variations of plating thicknesses could prevent insertion of components where the use of automation is employed for assembly. With this rigid control, the plating thickness will be duplicated from circuit to circuit. Other plating baths are silver, nickel, gold and rhodium, and combinations thereof. Here again extreme processing care is needed because of the susceptibility of the various materials to the chemicals.

As to future trends, one of the greatest advances in printed circuitry was the "plated through hole" board. This, sadly enough, was an expensive process as laminated copper boards are used—though only the holes have to be sensitized.

The next step in the evolution of the printed circuit will be the elimination of the use of copper pre-clad boards and by so doing, eliminate the destructive process of etching away the greater part of the conductive coating. The use of pre-clad copper boards is one of the most expensive aspects of making the printed circuit boards.

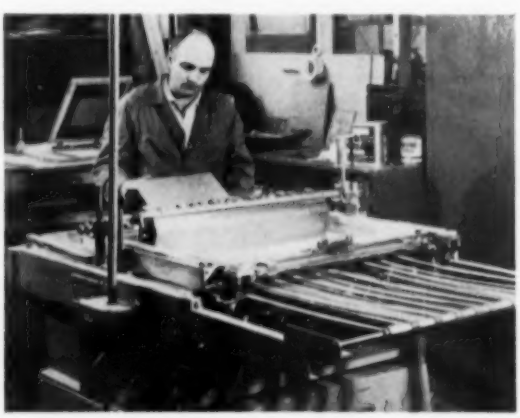

Fig. 4. A view showing the automatic silk screening machine used for large production runs.

This is only logical as in most printed circuit designs, the actual area of copper, or the picture that is left is usually only a fraction of the surface area of the laminate. Also by eliminating the pre-clad copper foil, the use of expensive etchant will be unnecessary. These two steps will drastically reduce the cost of the final product.

There are many other printed circuit processes in use today. Briefly outlined, here are a few of the most popular methods. One which has received considerable time and thought is the embossed circuit. In this method the heated die presses a copper foil into the laminate and at the same time the cutting action slices off the unwanted copper. There are many variations of this process using hot die stamping. However, they did not meet with too much success, because thin lines were practically buried in the laminate and, second the adhesion of the copper was poor and did not meet military standards.

The use of ceramic insulators with fired silver conductive lines is utilized to a great extent also. In this method the silver ink is screened on a pressed ceramic and fired at high temperatures fusing the silver on. There also are many variations to this process, particularly as to types of materials used.

The use of molten metal sprays also finds some application. In this process, molten metal is sprayed through stencils onto the insulator base. The fact that molten metals are used clearly shows why this process has not gained great popularity, and has found limited usage only.

The vacuum process has been finding increasing uses in small precision types of applications. As in most of the processes in use today one of the big deterrent factors has been the poor bond between the insulator base and the conductor. At our company for example, the bond strength between XXX-P phenolic and 0.0014 in. copper must be a minimum of 5 lbs per inch when tested in accordance with NEMA LPI paragraph 7.06. NEMA specifies a minimum of 3 lb with an average of 4 lb but to insure quality they have gone beyond these limits with 5 being required to get qualification approval.

Printed circuits for the military, where metal clad laminates are used, must meet extremely rigid environmental tests. The severity of these tests are a good governing rule to apply to all printed circuits no matter what method of fabrication is used. If this "rule of thumb" is used, many methods in use today would be eliminated. It would be in the interests of national security if all fabricators making commercial printed circuits had processes which would meet stringent military requirements.

Although this paper has stressed the military use of printed circuits, it is fully realized that civilian and commercial applications are using printed circuits. The washing machine and dryer mentioned earlier can, if necessary, stand the extra weight of a hand wired and soldered nerve system. In military applications the weight savings of the printed circuit may mean the difference of weight that would allow an aircraft to carry one more needed offensive or defensive piece of equipment. This is considered the vital use of printed circuitry, and is the reason why those engaged in the plating industries should become well acquainted with methods used in fabricating printed circuits.

To return to the "evolution" of printed circuits, except for the special types of circuits such as the fired ceramics and those previously mentioned, the most popular type will still be the phenolic base with copper as the conductive layer. However, it is desirable not only to cut material costs, but also production costs.

This brings us to what would be called the "Ideal Process." Briefly it is: The insulator board is fabricated to size. All of the drilling, punching and various shapings are complete before processing can begin. The board is coated by dipping or spraying with a thin adhesive which is compatible to the subsequent deposition of a thin conductive coating. After the metallic reduction is complete the coating is dried and hardened. The board is then photosensitized or screened with the proper pattern. This means only the desired circuit pattern is exposed. The board is then in succession copper plated and soldered plated (both from a fluoborate bath) or with any other deposits that are desired. The resist or stopoff is then removed and the thin conductive coating thus exposed is removed by a quick acid dip. As you can see this process eliminates the need for etching, which means the cost of the etchants would be eliminated, and permits the additional savings by buying just the plain unclad laminate material. There is a general trend in this direction in research laboratories and pilot production lines today.

What does all this mean to the electroplater? For the electroplater employed in industries utilizing printed circuitry it is a tremendous opportunity to learn something of the graphic arts, from the actual master drawing which is used for the photographic negative—to sensitizing with photo-emulsion—to the use of silk screening equipment—to the completion of a finished printed circuit board.

The electroplater engaged in private business will also find inquiries at his door from companies which do not want, or cannot afford to invest in a plating installation. A good sound knowledge of the fabrication of printed circuits may mean considerable expansion and consequently more business.

Printed circuitry is reaching out more and more into our everyday lives. The day is coming when only the simplest of electrical equipment will be hand wired and soldered. The day is coming when every large production plating shop will have its own precision plating setup to feed this growing young giant "Printed Circuits."

Harold Shapiro was born in Buffalo, New York. He studied chemistry at the University of Buffalo. Mr. Shapiro joined Sylvania Electric Products, Inc. in 1952 and is now that firm's Chief Chemist at their Electronic Systems Division in Buffalo. He was previously employed as a Chemical Analyst at the National Aniline Division of Allied Chemical and Dye Co. He is a member of the Buffalo Branch AES and the National Management Association.

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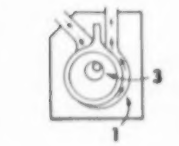

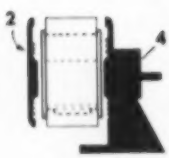

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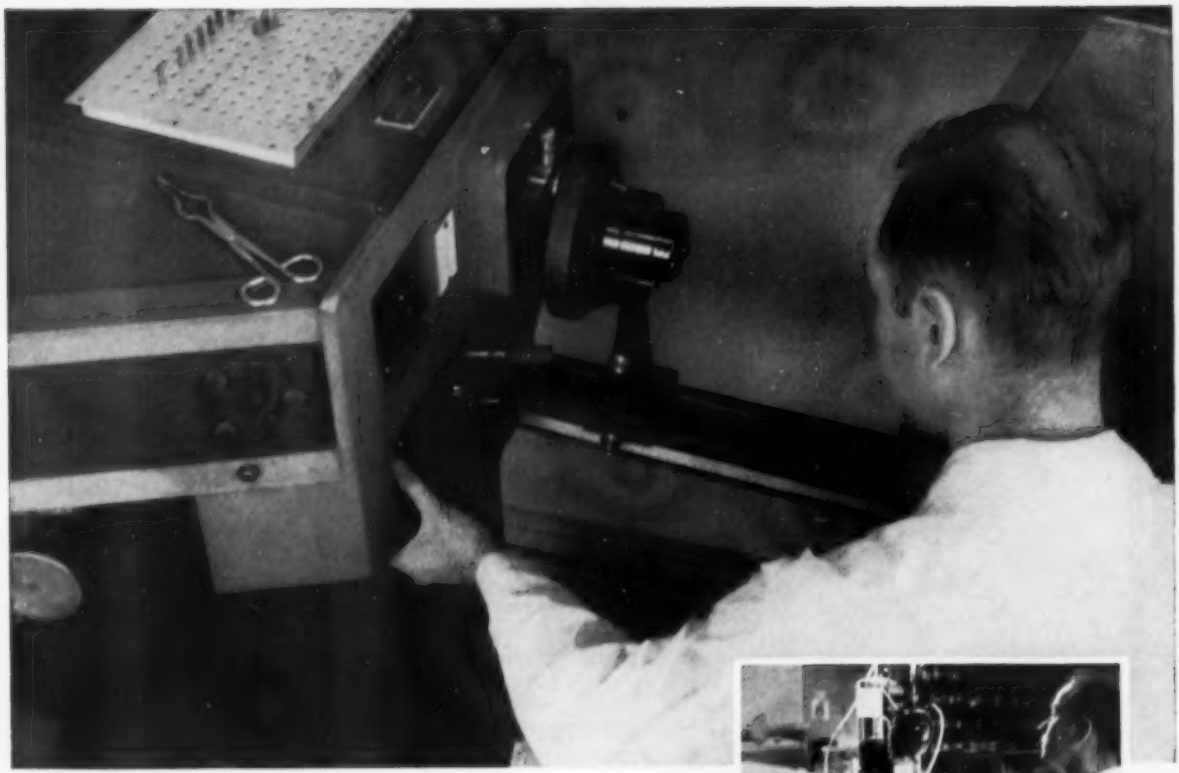

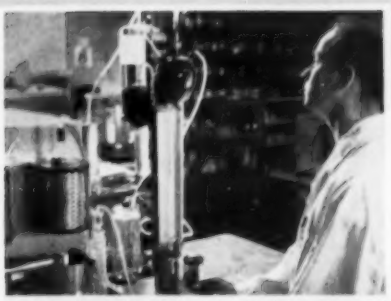

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"A few years ago we decided to make our Quality Control Lab as good as could be found anywhere. We staffed it with first rate people and bought the latest in equipment including the finest Spectrographic Instrument available. At this point, our accountant — you know the type — a nice enough guy, but never happy unless he's shaking his head and wiggling his fingers at you . . . said to me, 'Al, you must be crazy, putting all this money into Quality Control.'

"Well, it took a lot of doing—and plenty of dollars, but it was worth it. We've grown steadily and it sure is a nice feeling to know that many of our regular customers include the finest platers in the country."

Al Kerzner

AL KERZNER, *President*

If you're a user of Copper, Nickel or Zinc Anodes, and if quality (at a competitive price) is an important factor to you, contact us! We manufacture them in a variety of sizes and shapes, and we can make them to your specifications.

NEW JERSEY METALS COMPANY 722 Rockefeller St., Elizabeth 2, N. J.

Serving Industry from Coast to Coast — since 1920

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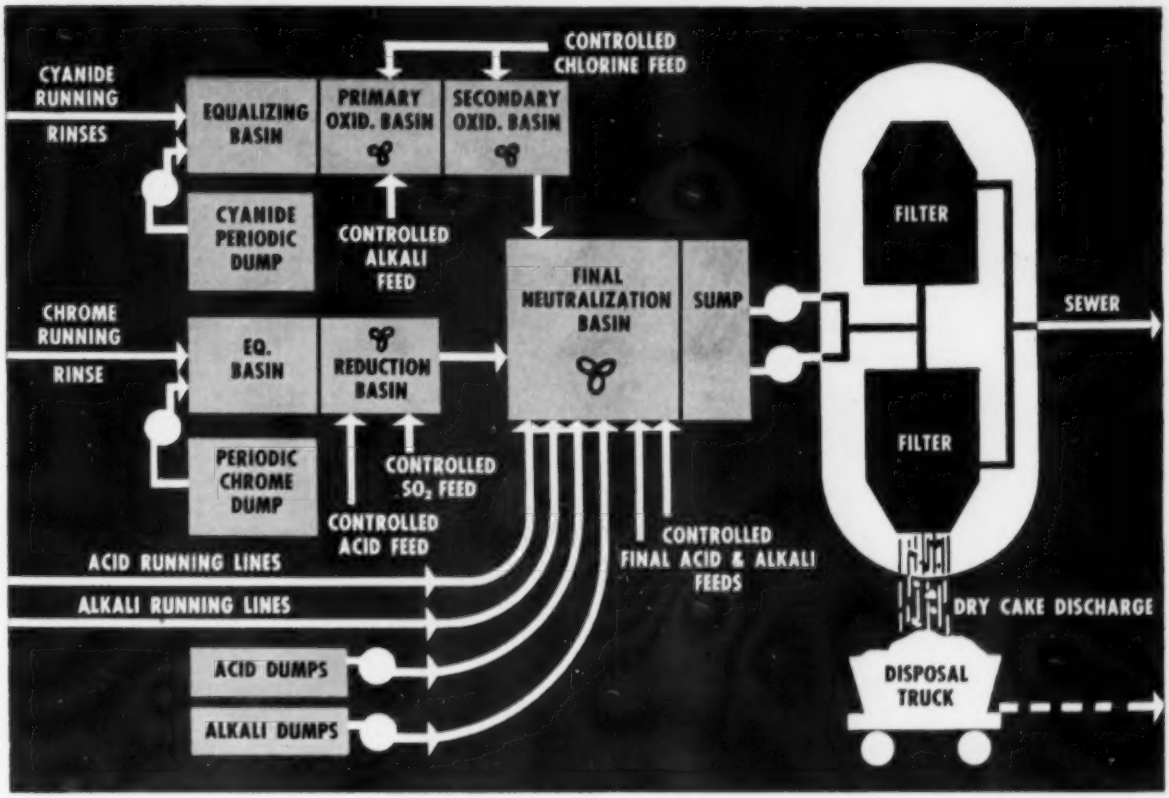


How to get rid of plating wastes without the cost or upkeep of conventional clarifiers

A large midwest appliance plant has several plating lines and wanted a centralized method for disposal of corrosive wastes. **When the bids were in, they chose this Industrial system** that uses compact modern filters instead of conventional clarifiers.

The plating lines discharge acid, alkali, cyanide and chrome wastes from rinsing operations and periodic dumps. Toxic chemicals are destroyed and then brought, together with other rinses, to a central basin where they neutralize one another, requiring only small amounts of added chemicals to precipitate the dissolved metals and permit their separation by filtration. The filters extract the solids and discharge a neutral non-toxic effluent to the city sewage system.

The tremendous advantages of this advanced system over conventional clarification and lagooning systems are pointed up in a simple check list:

- ✓ **Cost . . . half as much**
- ✓ **Construction . . . no excavation or complex concrete work**
- ✓ **Space . . . about 90% less for entire system**
- ✓ **Waste disposal . . . dry cake, discharged by mechanical shakers directly from filters into trucks**
- ✓ **Maintenance . . . overall maintenance much lower; clarifier mechanisms, sludge pumps and vacuum filter are replaced by two Vertical Leaf filters with push-button control**

This is typical Industrial engineering . . . modern equipment skillfully designed into a time and cost saving system. On **your next plating problem—call Industrial** . . . you'll find our engineers the most experienced in the industry at handling plating fluids, from water purification to waste disposal.

Send for complete data . . .

INDUSTRIAL

FILTER & PUMP MFG. COMPANY
5914 OGDEN AVENUE • CHICAGO 50, ILL.

Please send me literature and reprints of articles on plating waste disposal.

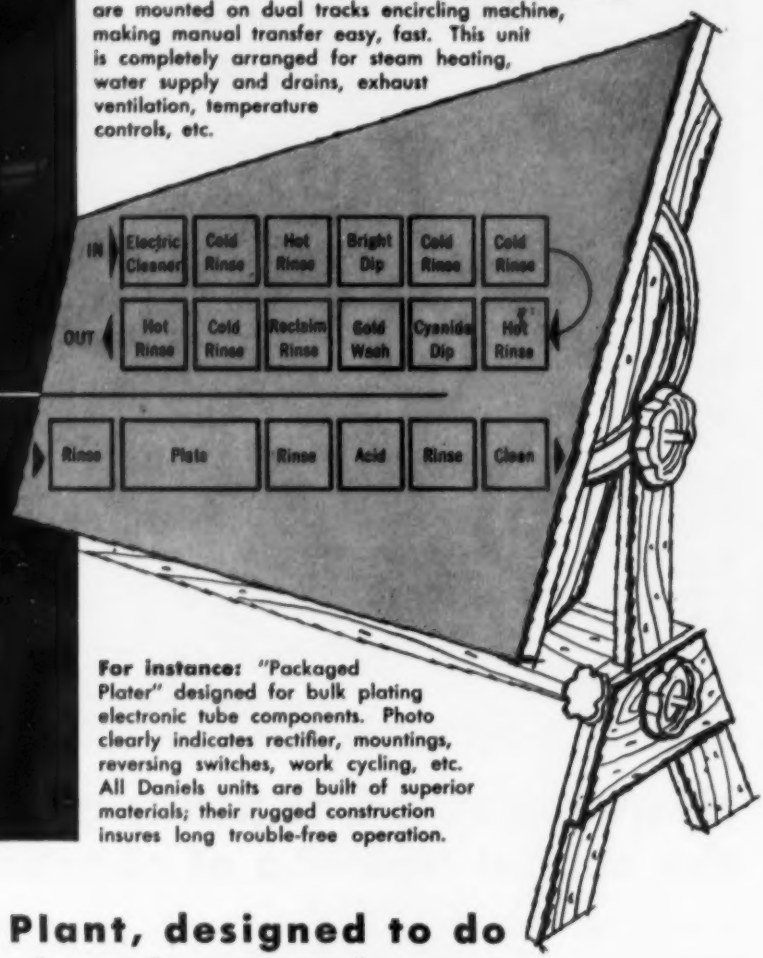
NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

For instance: This 12-station machine for gold plating small electric meter parts. Unique in that cylinder assemblies are mounted on dual tracks encircling machine, making manual transfer easy, fast. This unit is completely arranged for steam heating, water supply and drains, exhaust ventilation, temperature controls, etc.



For instance: "Packaged Plater" designed for bulk plating electronic tube components. Photo clearly indicates rectifier, mountings, reversing switches, work cycling, etc. All Daniels units are built of superior materials; their rugged construction insures long trouble-free operation.

YOUR Plating Plant, designed to do your work and yours alone

—at a cost that will surprise you!

DANIELS custom-packaged plants, completely self-contained, are usually designed around a complete cycle. Their compactness results in conspicuous savings on installation cost, floor space — and fewer rejections because you get uniform production and high quality control.

FREE: Write today on your letterhead for illustrated booklet describing Daniels Custom Packaged Platers—and Daniels standard plating barrels too.

41 years of dependable service

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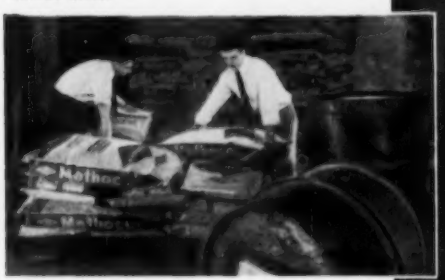
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 631.

INVENTORY ERROR threatens to halt production at the plant of a large manufacturer in Wisconsin. Unless supplies of two critically needed chemicals are delivered by early evening the second shift will have to be sent home. A long distance call is put through to Merchants' Milwaukee office.



MERCHANTS' WAREHOUSE has been closed for half an hour when the call comes in, but two of the Merchants sales staff volunteer to stay late to help meet the emergency. They load sixty bags and two drums of chemicals onto trucks and flats, ready for pick-up.

AT 8:00 P.M. MANUFACTURER'S TRUCK ARRIVES, is loaded quickly, takes off for a fast return trip. Dinner was late that night for the two Merchants men, but they had been able to help a customer out of a tight spot. That kind of customer service is a tradition at Merchants Chemical.

THEY WERE READY TO SEND THE SECOND SHIFT HOME, UNTIL...

Merchants' Service solved critical supply problem

A distributor, chemical or otherwise, sells service. At Merchants Chemical, service may take the form of emergency accommodation, as in the example cited above; or it may mean experienced technical advice, or special repackaging to help meet a particular production problem. Whatever your need, you'll find that each Merchants office is ready to give your order the special attention it deserves. Merchants serves you from sales offices and stock points across the country. Products offered include acids, alkalis, fungicides, surfactants, chlorinated solvents, emulsifiers, laundry compounds, soaps, dry ice and chemical specialties.

MERCHANTS CHEMICAL COMPANY, INC.

60 East 42nd Street, New York 17, N. Y.

SALES OFFICES AND WAREHOUSES: Chicago • Cincinnati • Columbus • Denver • Louisville • Milwaukee • Minneapolis • New York • Omaha

STOCK POINTS: Albuquerque, N. M. • Erwin, Tenn. • S. Norwalk, Conn.

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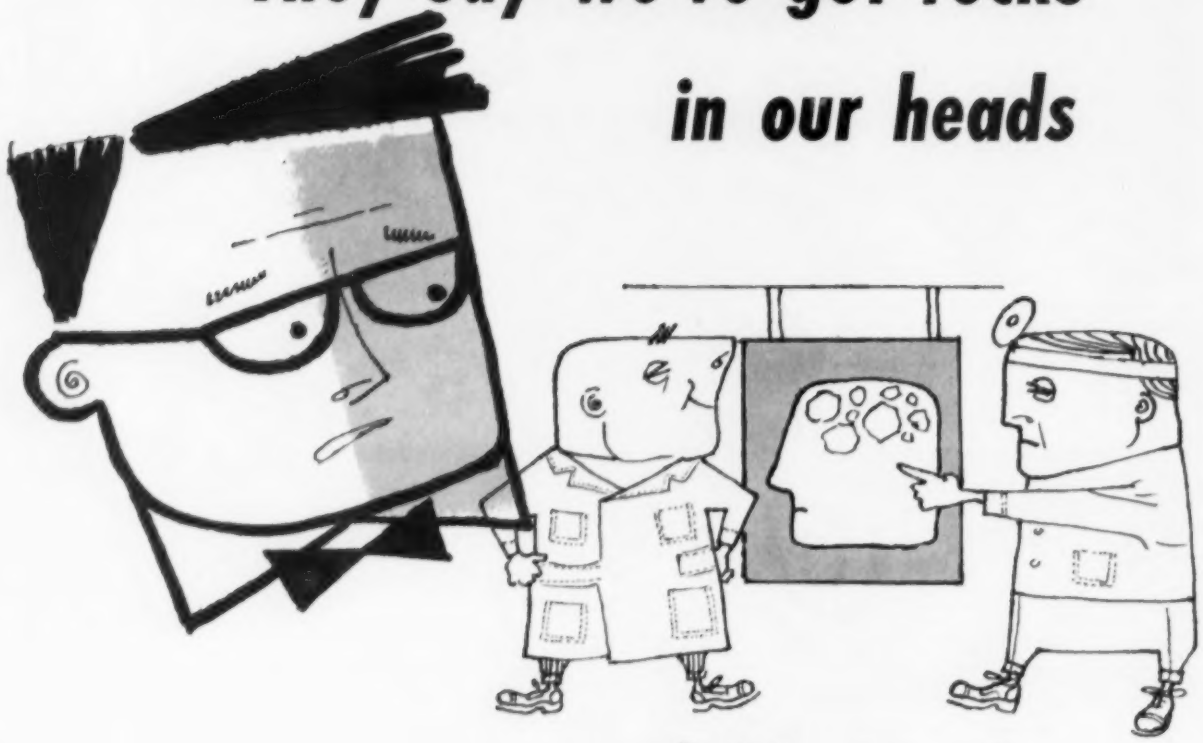
They say we've got rocks in our heads



—and it's true!

We really don't mind this sort of talk. It's our business to have the types of "rocks" on our minds that are saving millions of dollars in the finishing of manufactured parts.

Roto-Finish people have studied abrasive chips and compounds since the day they pioneered the idea of precision barrel finishing. The development of new and better media for specific finishing problems has made Roto-Finish the leader in mechanical finishing. Years of research and experience in barrel finishing techniques give Roto-Finish the "know-how" to recommend the right media to do the job you want done.

If you're not satisfied with your finishing production, look to Roto-Finish for the answer. Simply send samples of your unfinished parts, a finished part, a description of your production requirements and a list of the equipment you have available. We'll prove that you can save with Roto-Finish and we'll guarantee the same results in your plant that are achieved in sample processing.

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TECHNICAL DATA FOLDER
ON ROTO-FINISH PROCESSES

Roto-Finish
COMPANY
3703 Milham Road
Kalamazoo, Mich.

ROTO FINISH

Phone:
Fireside 3-5578

FOREIGN REPRESENTATIVES: CANADA — Toronto — Canadian Hansen & Van Winkle Co., Ltd., Cor. Silver and Morrow Aves. ENGLAND — Mark Road — Hemel Hempstead — Hertfordshire — Roto-Finish Ltd. AUSTRALIA — Cheltenham, 89 Tulip St., A. Flavell Ltd. HOLLAND — BELGIUM — LUXEMBURG — Delft, Holland — N.V. Roto-Finish Maatschappij Rotterdamseweg 370A AUSTRIA, GERMANY, SWITZERLAND, NORWAY, SWEDEN Frankfort a.M.—Metallgesellschaft A.G., Germany — Reuterweg 14 ● ITALY — Milan — Societa Roto-Finish a R.L. — Seitos S. Giovanni — Viale E. Marelli 31 ● FRANCE—Paris Societe Roto-Finish, 40-42 rue Chance Milly—l'Ichy, (Seine) ● BRAZIL — Rio de Janeiro — Commercial E. Industrial de Formos Werco, Ltds. rua General Gurjao, 326 ● SPAIN — Barcelona — Instituto Electroquimico, S.A. — Corcega 59.

Low-Cost Walker Rectifiers Can Solve your Electroplating and Anodizing Problems

- ***Walker Work-Saver Feature***
- ***No Moving Parts***
- ***Dependable***
- ***Efficient***

With the quality-made Walker Rectifier — Silicon, Germanium, Selenium — you get the rectifier that's built for long years of trouble-free life. And, the Walker Work-Saver feature automatically cuts current back to a pre-determined level whenever necessary to prevent work spoilage.

Engineered to deliver maximum service at minimum cost, Walker Rectifiers have a power factor of 97% and a D.C. ripple of about 4%.

Quality-made Walker Rectifiers are designed and manufactured to the highest standards. With no moving parts, there's nothing to wear out, nothing to get out of adjustment.

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The **Walker** DIVISION
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Mail this coupon now and get full details on why you get more for your dollar

THE WALKER DIVISION
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Please send me complete details on your rectifiers.

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CITY ..... STATE .....

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They're all 999+FINE

A WORD ABOUT REFININGS

Send your silver plating solutions and other precious metal scrap, sweeps and waste to us for refining. Specially perfected scientific methods and equipment plus highly skilled technicians and long experience assure you of an *accurate return* from every lot. Send us your next shipment and let returns speak for themselves.

HANDY & HARMAN SILVER ANODES

Regardless of form, all Handy & Harman Silver Anodes are made of the same super-fine silver—silver fabricated by an exclusive production process that . . . maintains the highest standards of fineness . . . removes every trace of impurities detrimental to plating . . . assures consistent uniformity. These 999+FINE Anodes are turning out top-quality, trouble-free plating for thousands of manufacturers. They'll do the same for you. TRY them and see the difference.

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New Product KENVERT® 17-A

Most applications show 75% savings to manufacturers making their own bright dips . . . for brightness and corrosion protection . . . we are doing it today for others . . . we solicit your inquiry.*

KENVERT® 17-A PROPERTIES

- No leach
- Low concentrations (2–3% solution)
- High corrosion protection (in excess of 40 hrs.)
- No waste disposal problems of rinse waters
- Excellent brightness
- Chrome color
- Operate cold
- Easy to replenish
- Good solution life—simple to operate and control
- Operates 5–50 secs. dip
- Minimum metal removal
- Low rinse water consumption
- Powder—no returnable containers (no freight on water)
- 3–5¢/gal. treating solution

*KENVERT 16—Brightens and polishes for those whose specifications demand the highest quality deep polish.

CADMIUM PLATERS—KENVERT #27 (a powder requiring no leach). For a really *bright white* finish without iridescence.

Please contact our distributors listed below or drop us a line on your company letterhead.

ALERT SUPPLY COMPANY
Los Angeles, California
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ARDCO INCORPORATED
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GREAT WESTERN CHEMICAL COMPANY
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S. A. DAY COMPANY
Buffalo, New York

CHIPMAN SUPPLY COMPANY
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GEORGE L. NANKERVIS COMPANY
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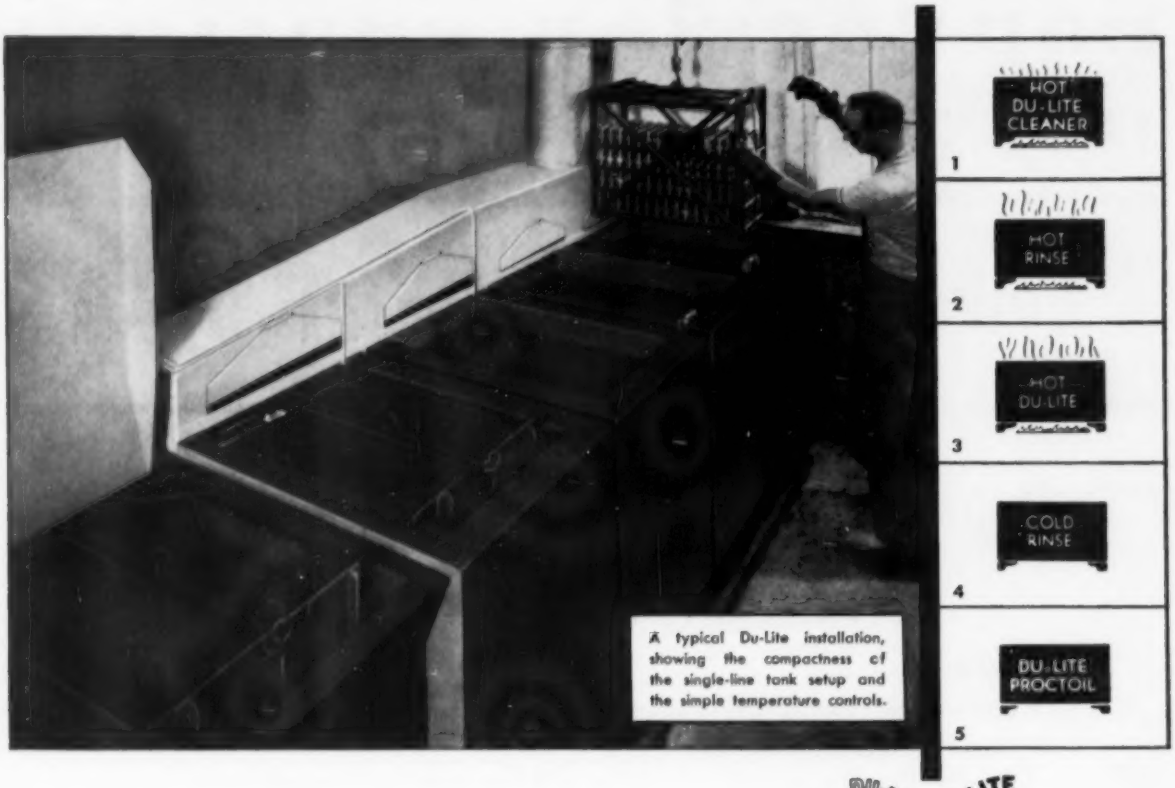
CONVERSION CHEMICAL CORPORATION
100 E. MAIN STREET ROCKVILLE, CONN.

Du-Lite METAL FINISHING SPECIALISTS



A typical Du-Lite installation, showing the compactness of the single-line tank setup and the simple temperature controls.

Du-Lite's metal finishing line includes cleaners, strippers, blacking agents, wetting agents, passivating agents, rust preventatives, burnishing compounds etc. for any type of metal. Let Du-Lite solve your finishing problems. Complete Du-Lite service includes free processing of samples of your parts to demonstrate Du-Lite quality and economy, field engineers right near your plant to help you with your steel finishing riddles, and research on specific metal finishing problems.

The Du-Lite process requires five tanks, only three of which require heat, including one with a controlled temperature. The installation may, of course, be as elaborate as individual requirements demand. Setup can be tailored to handle the type and volume of the parts to be finished. Du-Lite engineers will be glad to assist you in planning the installation and securing the necessary equipment. The simplicity of the Du-Lite process may be readily appreciated from the following outline:

Visit us at the
44th Annual Convention
of the American Electroplaters Society

DU-LITE DU-LITE
STEEL COLORING PROCESS

STEP 1 **Clean by immersion for five minutes in a good, hot soak cleaning bath. We recommend Du-Lite #29 cleaner with Titronne.**

STEP 2 **Rinse in hot water.**

STEP 3 **Immerse for five to fifteen minutes in Du-Lite bath at 290° to 300° F. (On certain types of heat treated steel normally requiring immersion for longer periods, time can be saved by immersing in a second bath for five to ten minutes at a higher temperature.)**

STEP 4 **Rinse thoroughly in cold water.**

STEP 5 **Immerse for two to five minutes in water displacing oil, remove, and drain. Du-Lite Proctoil will leave a protective oil film on the surface.**

Du-Lite

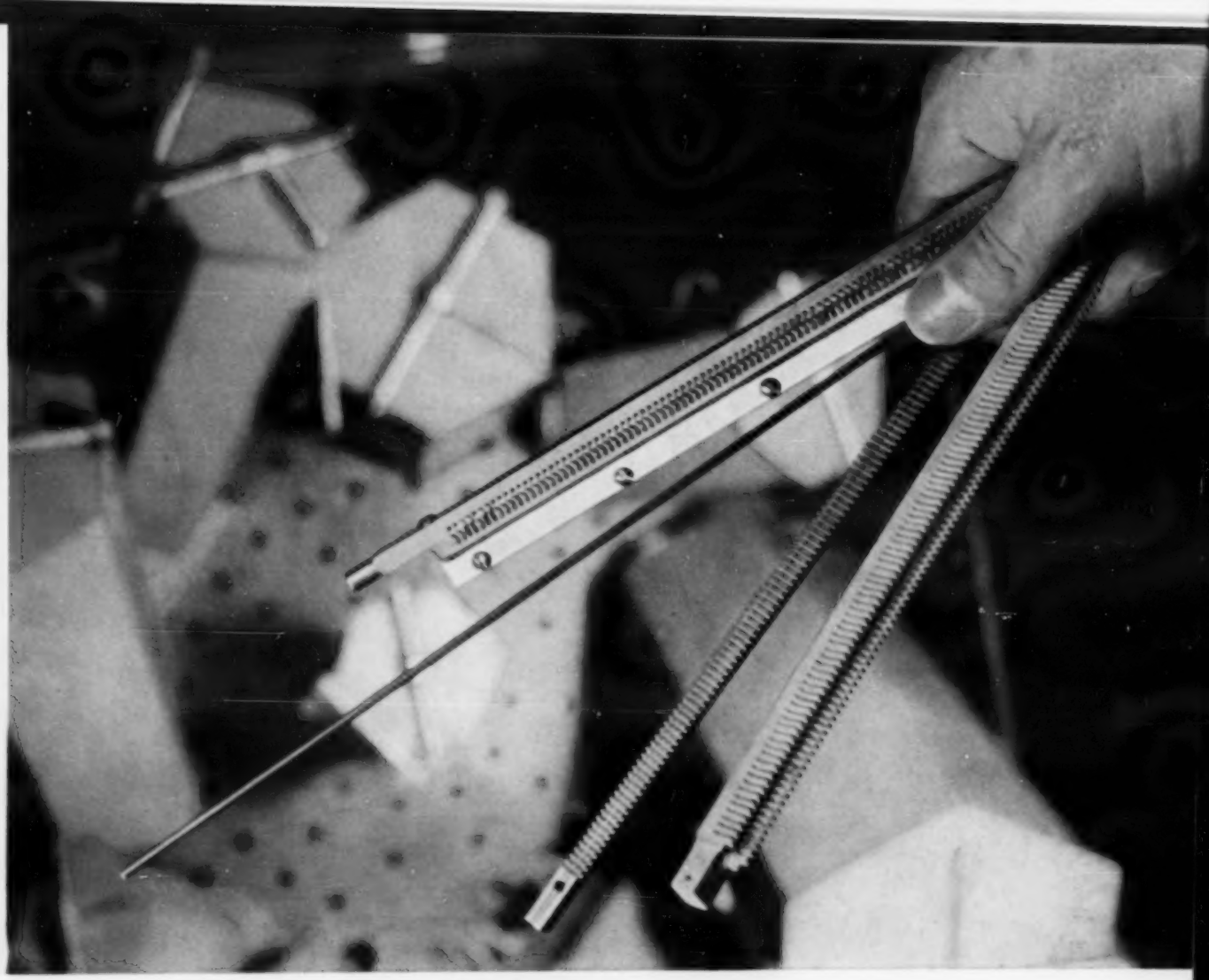
THE DU-LITE CHEMICAL CORPORATION · MIDDLETOWN, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 637.

INDICATE B 604. ➤

Barrel Finishing... "on-spec"

For consistently more uniform finishes even on intricate metal parts like these, use Tumbling Grains by CARBORUNDUM. Fused aluminum oxide particles in CARBORUNDUM Tumbling Grains are tough and blocky... made to produce a continuous honing action for rapid stock removal or for ultra-fine finishes. In addition to tumbling grains, Carborundum also manufactures a complete line of abrasive tumbling media, including nuggets, and controlled vitrified and rubber bonded shapes. Ask your Carborundum Distributor or Salesman for a description of the wide variety of sizes available. Or write The Carborundum Company, Niagara Falls, New York, and ask for Booklet A-1461. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.



Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **ELECTRO MINERALS DIVISION**

CARBORUNDUM ... also makers of a complete line of Bonded and Coated abrasives

Another Richardson Allen Engineering "First"

Demonstrating the same unsurpassed initiative, ingenuity and craftsmanship which, over the years, have set the pace of progress for the entire industry. Richardson-Allen engineers—working in close cooperation with Westinghouse engineers—have developed and perfected the ultimate in power rectification.

SILICON

DEPENDABLE POWER RECTIFIERS

HERMETICALLY SEALED JUNCTIONS—
HIGH TEMPERATURE OPERATIONS

VERSATILITY—Richardson-Allen silicon rectifiers are now available for the plating and industrial fields in ratings up to 500 kws.

EFFICIENCY—Richardson-Allen silicon rectifier units are now supplying major industries with an unprecedented amount of direct current—with no loss in efficiency, no aging and no apparent limit to the life of the silicon junctions. Single silicon junctions are designed to withstand up to 300 vpi.

ECONOMY — Occupying unbelievable small space, the initial cost is often lower than other conversion methods; practically no maintenance is ever needed and when installation savings and power savings are figured the total amount is impressive.

For additional information, write to:

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ANNUAL REPORT

FOR THE FISCAL YEAR ENDED MARCH 31, 1957

PRESIDENT'S REPORT

by

Dr. Samuel Heiman

Your Society has moved forward during the past year along many lines. This progress was built upon the strong foundation of those who preceded us and we continued to build upon the good work they had started. We hope, in turn, that many things started this year will bear fruit in years to come.

This brief report gives only a bird's-eye view of these developments. Further details of many points will be found in the reports of other officers and committee chairmen which follow.

During the year, the following meetings of the Executive Board were held:

Washington, June 22, 1956 (Following the Washington Convention)
New York, September 29, 30, 1956
Pittsburgh, January 11, 13, 1957 (On January 12, the Executive Board attended the Interim Meeting)
Newark, March 16, 1957 (Special Meeting)
Newark & New York, April 26, 27, 1957
Montreal, June 16, 1957 (Scheduled—before the Convention)

BRANCHES

The strength of the American Electroplaters' Society is the strength of the Branches. I am sure that those of us who have been privileged to speak to many Branches and discuss problems with their officers are more than ever firmly convinced of this.

Your President visited twelve Branches during the year, including the five West Coast Branches. It is regretted that several branch meetings were missed as a result of a tight schedule or previous commitments. Other members of the Board visited 28 Branches bringing the total to 40 Branches. Several meetings of the Research Committee, Editorial Board and Montreal Convention Committee were also attended.

During the past year, temporary charters and later, permanent charters were granted to British Columbia and Miami Branches.

These Branch visits by National Officers have provided an invaluable opportunity for the exchange of ideas and suggestions and have kept the Branches informed first hand of Executive Board and National Society actions and policies.

The Branch Officers' Manual was completed during the year and published as a 255-page loose-leaf book in January, 1957. This Manual represents a wealth of direct experience in Branch management and operation and should help make the work of the officers more efficient and effective. It is recommended that the various sections of the Manual be revised from time to time by the Society committees concerned.

BOARDS AND COMMITTEES

A large part of the work and progressive policy making of the Society is done by the various committees. These are composed of men who devote a considerable amount of time and energy to the good of the Society. On behalf of the Society, I wish to express our appreciation and thanks for their work done during the past year. These committees are fully listed elsewhere in this Annual Report.

The new approach to Society committee operation involves permanent committees of which only a part are replaced annually, similar to the procedure which has proven successful on the Research Committee and Editorial Board.

There is a great need for qualified members to do national Society committee work. This can be a richly rewarding experience for those who participate. It is hoped that this committee work where possible will be done by larger numbers of members in all the Branches instead of overworking a relatively few "old reliables."

Education, Membership and Research

The full reports of the education, membership and

Dr. Samuel Heiman

research committees are discussed in detail in other reports which follow.

It is noted here that the educational activities continue to be the basis and prime concern of your officers.

The total membership of the Society rose from 7,101 on April 1, 1956 to 7,521 on April 1, 1957, an increase of about six per cent.

The Society's Research Program, supported by 339 forward-looking sustaining members and directed by the capable Research Committee, moved along at high gear. Eight projects were active and over $34,000 was spent on this work.

Public Relations

The Public Relations Committee drew up its bylaws during the past year and now has a ten-man committee of which three will be replaced each year. The Executive Secretary is a permanent member. A considerable amount of thought and planning has been done and we may now expect more results in this field in which there is so much to be done.

Paper Awards

Acting on the recommendations of the Editorial Board, the Executive Board approved a revised schedule of awards for the best papers published in the Society's publication PLATING and the "Technical Proceedings." This new schedule, if approved by the Supreme Society, will create new awards and increase the monetary value of others. This is expected to increase the incentive to submit papers to our publications.

Publications

Work on the Process Control Handbook has continued during the past year and it is now promised for completion in the summer of 1957.

Consideration is being given to the publication of other books by the Society. Continued attention and action should be given to this project.

SPECIAL AES COMMITTEES

Organic Finishing

This work was considered of such primary importance that the Third Vice President was assigned to direct this activity. A full review will be found in his report. Several tangible advances have resulted from this work.

1. A special issue of PLATING, March 1957, was devoted to Organic Finishing. This served to focus attention on the Society's interest in this field.
2. The Milwaukee Branch has attracted national attention by its special Branch programs designed to meet the needs of its members who are interested in organic finishing as well as plating and surface treatments (see PLATING, March 1957, page 306).
3. Increased attention by the Branches to this field as a result of the above efforts.

Structure of the Society

The Milwaukee Resolution, adopted by the Supreme Society at the 1956 Washington Convention, asked that a special study be made of the "structure, effectiveness and services of the Society and its related publishing activities." The Executive Secretary, a management and publishing specialist, was appointed by the Executive Board to this task, and a progress report was submitted by him to the delegates at the Interim Meeting. Subsequently, a supplementary committee was appointed and its recommendations, together with the Executive Secretary's will be presented for Supreme Society consideration and action at the annual meeting in Montreal.

NATIONAL PRESIDENT INSTALLS BRITISH COLUMBIA BRANCH

National President Samuel Heiman journeyed cross-country in late March 1957 and installed the British Columbia Branch as the AES's 55th Branch. Left above, William J. Marquardt, Branch President accepting the charter from Dr. Heiman at an impressive ceremony in Vancouver. In late April 1957, moreover, the Miami (Florida) Branch was voted its permanent charter by the Executive Board and will soon be formally installed as the Society's 56th Branch.

AES Award for Scientific Achievement

The Executive Board at its September meeting approved the desirability of creating a special award for outstanding scientific achievement. A special task committee was appointed to work up the details of this award. This committee has been working diligently during the past year and will present its recommendations to the Executive Board. Final action by the Supreme Society will be required. If approved, it is expected that the first award would be made at the Cincinnati Convention in 1958.

Electroplating Courses

During the past year increasing attention was given to the plating class program. New courses were started in the following branches: St. Louis, Indianapolis, St. Joseph Valley, Detroit and Springfield. This makes a total of 18 classes sponsored in full or part by AES Branches. Courses are also under current consideration by the Southern Tier, Mississippi Valley, San Francisco, Portland and British Columbia Branches.

This activity merits the full and continued support of the Society at all levels.

Constitution and Bylaws

During the year changes in the Constitution and Bylaws have been referred to these committees for consideration and study. This large number of revisions reflects the thought which has been given to changes that are believed necessary for this growing society to meet new conditions as they arise.

These revisions will be publicized in advance of the annual business meeting at which time the Supreme Society will vote on their adoption or rejection.

INTERSOCIETY REPRESENTATION

The growing stature of the Society is attested by the continued and increasing cooperation with other technical societies and groups. These committees are listed elsewhere in this Annual Report.

The annual reports of these intersociety representatives will be given to the delegates at the Montreal Convention. The close and cooperative efforts with several committees of the American Society for Testing Materials is worthy of special note and this should continue to develop. The recent substantial financial contribution of American Society for Testing Materials (ASTM) to the Research Program is noted and appreciated.

Increased cooperation with the National Association of Metal Finishers was effected during the year and the time is now ripe for a larger increase in our mutual efforts.

The International Council for Electrodeposition is already making preliminary plans for the Fifth International Conference which will be held at the 1959 Detroit Convention.

Our representative to the National Technical Task Committee on Industrial Wastes was chairman of this important Committee this year—a signal honor.

INTERIM MEETING

The Fourth AES Interim Meeting of the Supreme Society was held in Pittsburgh on January 12, 1957. Sixty-nine delegates and representatives from 25 Branches attended.

Reports dealing with the operation of the Society were presented and many current problems were discussed. The actions taken at this meeting were presented in the February 1957 issue of PLATING. The complete stenographic report was published and distributed to delegates, alternate delegates, presidents and secretaries of all branches.

CONVENTIONS AND EXPOSITIONS

The way in which the Branches vie for the privilege of holding a convention—and once obtained, work to make theirs the "best ever"—is an example of the fundamental vitality of the Society. The 1957 Montreal Convention Committee has been working diligently and effectively during the past year in preparing for this major educational and social event of the year. The Editorial Board has organized a fine educational program for this convention.

The fundamental policy of the Society regarding the handling and management of the Industrial Finishing Exposition came under considerable study during the year. The following decision was made: The Detroit Branch will have full responsibility for the operation of the 1959 Detroit Exposition subject to policy and financial supervision by the Executive Board. The full and detailed instrument of this arrangement was worked out, however, the Exposition following Detroit, to be held in 1961 or 1962, will be under the direction of AES Headquarters.

SOCIETY PUBLICATIONS

PLATING, the main product of our National Headquarters, received continual attention from the Staff, the Editorial Board, the Executive Board and many others aiming toward continual improvement and increased value to the members. We believe, you will agree, that this improvement has continued to take place during the past year. We believe that even further improvement may be expected in forthcoming issues.

The 1956 "Technical Proceedings" contained the 42 papers which were presented at the Washington Convention. This was much larger than the usual number of approximately 25 at other recent conventions. Nevertheless, the book was published and distributed by Mid-November—a fine achievement for our Staff and all concerned.

ACKNOWLEDGMENTS

Once again I would like to thank the many Branch Officers, committee members, my colleagues on the Executive Board, the Executive Secretary and all of the other members of the staff at National Headquarters for the fine work they have done and for their support and cooperation during the past year. The progress recorded here is the work of many people each contributing according to his special abilities. I also wish to thank the Philadelphia Rust-Proof Company for their full support during the past four years.

It has been a privilege and an honor to serve as your president during the past year.

The Executive Board in Session. (Left to right) Herberth E. Head, second vice president; Francis T. Eddy, first vice president; Dr. Samuel Heiman, president; John P. Nichols, executive secretary; Ralph D. Wysong, third vice president; Clyde Kelly, past president.

AES Income vs. Expenses

	INCOME	EXPENSES
1951-1952–	$143,833.00	$114,849.00
1952-1953–	$157,189.00	$139,591.00
1953-1954–	$168,041.00	$156,765.00
1954-1955–	$184,295.00	$168,199.00
1955-1956–	$203,158.83	$211,689.30
1956-1957–	$211,635.97	$211,616.76

Net Worth, General Fund

1951-1952—$113,242.00
1952-1953—$150,918.00
1953-1954—$166,370.00
1954-1955—$182,465.00
1955-1956—$188,578.30
1956-1957—$188,225.01

Membership Expansion*

1951-1952—5914 Members
1952-1953—6377 Members
1953-1954—6739 Members
1954-1955—6860 Members
1955-1956—7101 Members (Corrected)
1956-1957—7521 Members

* *Includes Active, Members-at-Large, and Sustaining Members.*

Plating Paid Circulation

1951—6702 Subscribers
1952—6909 Subscribers
1953—7432 Subscribers
1954—7821 Subscribers
1955—8087 Subscribers
1956—8299 Subscribers
1957—8688 Subscribers (April 1)

Membership Report as of March 31, 1957

BRANCH	MEMBERSHIP MARCH 31, 1956 (CORRECTED)	ELECTED	REINSTATED	TRANSFERRED IN	TRANSFERRED OUT	RESIGNED	SUSPENDED	DEAD	NET GAIN	MEMBERSHIP MARCH 31, 1957	SUSTAINING MEMBERS
Adelaide	45	4	—	—	—	1	6	—	− 3.0	42	—
Allentown-Reading	40	9	—	—	1	1	7	—	+ 0.5	40	3
Baltimore-Washington	99	11	—	1	1	4	4	1	+ 2.0	101	5
Boston	130	11	3	1	—	—	—	3	+11.5	140	5
Bridgeport	149	9	—	—	4	3	2	2	—	149	5
British Columbia*	14	23	—	1	—	—	—	—	+23.5	38	—
Buffalo	103	17	3	3	1	2	8	1	+10.0	114	1
Capitol District	56	6	3	—	3	2	16	—	−10.5	44	2
Central Michigan	60	1	—	—	—	3	3	—	− 5.0	55	—
Chicago	456	24	2	3	4	1	5	2	+17.5	473	72
Cincinnati	100	17	—	2	2	8	3	—	+ 6.0	106	2
Cleveland	280	31	14	2	7	3	34	1	+ 4.5	282	21
Columbus	71	8	1	1	—	6	3	—	+ 0.5	72	—
Dallas-Fort Worth	54	5	1	3	—	3	10	1	− 6.5	49	1
Dayton	98	27	3	1	1	2	3	—	+25.0	123	5
Detroit	672	76	19	2	9	23	55	1	+ 2.5	681	46
Grand Rapids	183	16	1	2	5	2	13	2	− 1.5	180	16
Hamilton	28	7	—	—	—	1	1	—	+ 5.0	33	4
Hartford	168	20	2	2	2	7	11	1	+ 3.0	171	5
Houston	31	4	1	1	—	1	—	—	+ 4.5	36	1
Indianapolis	113	7	—	2	—	2	2	—	+ 4.0	118	2
Kansas City	53	6	—	—	1	—	14	—	− 8.5	44	—
Lancaster	71	4	—	—	—	2	8	1	− 7.0	64	2
Los Angeles	309	52	3	9	1	8	45	3	+ 3.0	316	18
Louisville	47	7	—	—	—	1	4	—	+ 2.0	49	1
Melbourne	160	15	8	—	1	4	17	—	+ 1.5	161	—
Miami (A)	9	22	—	—	—	—	—	—	—	31	—
Milwaukee	187	40	—	4	1	1	3	2	+35.5	224	14
Mississippi Valley	43	17	—	2	—	—	2	—	+16.0	60	2
Montreal	89	21	3	1	4	1	—	2	+19.5	107	3
Newark	271	62	—	6	1	5	2	1	+56.5	330	10
New Haven	96	24	—	3	—	1	1	—	+23.5	121	3
New York	337	26	7	1	1	5	19	1	+ 8.0	345	12
Philadelphia	222	30	6	1	1	2	20	1	+13.0	235	13
Pittsburgh	132	15	1	2	3	—	7	1	+ 7.5	139	4
Portland	21	5	—	—	—	—	3	—	+ 2.0	23	—
Providence-Attleboro	95	7	1	—	1	—	4	2	+ 1.5	96	2
Rochester	91	12	1	—	—	7	3	2	+ 1.0	92	4
Rockford	75	9	—	—	1	—	3	—	+ 5.5	80	1
Saginaw Valley	111	21	—	—	2	7	2	—	+11.0	121	—
St. Joseph Valley	89	31	2	2	—	—	6	—	+28.0	118	5
St. Louis	96	14	2	—	4	4	5	—	+ 5.0	99	12
San Antonio	18	—	—	—	1	—	1	—	− 1.5	16	—
San Francisco	80	12	—	—	—	—	—	1	+11.0	91	—
Seattle-Puget Sound	35	7	—	1	—	3	4	—	+ 0.5	36	—
Southeastern	70	17	—	2	1	6	—	—	+11.5	82	1
Southern Tier	35	7	3	—	—	—	6	—	+ 4.0	39	1
Springfield	59	9	1	1	1	3	2	—	+ 5.0	64	2
Sydney	98	7	—	—	—	2	3	—	+ 2.0	100	—
Syracuse	113	10	6	—	—	2	22	—	− 8.0	105	1
Toledo	47	3	—	—	—	2	3	—	− 2.0	45	1
Toronto	164	28	2	4	1	9	8	—	+14.5	180	11
Twin City	76	16	3	—	2	6	1	—	+11.0	86	—
Waterbury	143	9	—	2	3	4	4	1	− 0.5	142	16
Western Ontario	33	5	—	—	—	1	—	—	+ 4.0	37	3
Wichita	48	7	—	—	—	5	9	—	− 7.0	41	1
Members-at-Large	210	34	4	1	5	3	24	1	+ 8.0	216	—
TOTALS (B)	6783	(C) 944	106	69	76	169	441	34	+402.5	7182	339 (D)

* New Branch.

(A) Temporary Charter as at April 1, 1957. Permanent Charter approved April 27, 1957.

(B) Net gain is computed by rating transfers at .5.

(C) Deducting Miami (9) and British Columbia (14) not members on April 1, 1956 makes total 6760. Adding 341 Sustaining Members total was 7101 on April 1, 1956.

(D) Adding 339 Sustaining Members to 7182 makes total membership 7521 at April 1, 1957.

FIRST VICE PRESIDENT'S REPORT

by
Francis T. Eddy

THE many activities of the Society have been the concern of your First Vice President during the last year. Mainly, these programs have involved the Educational aspects of our work.

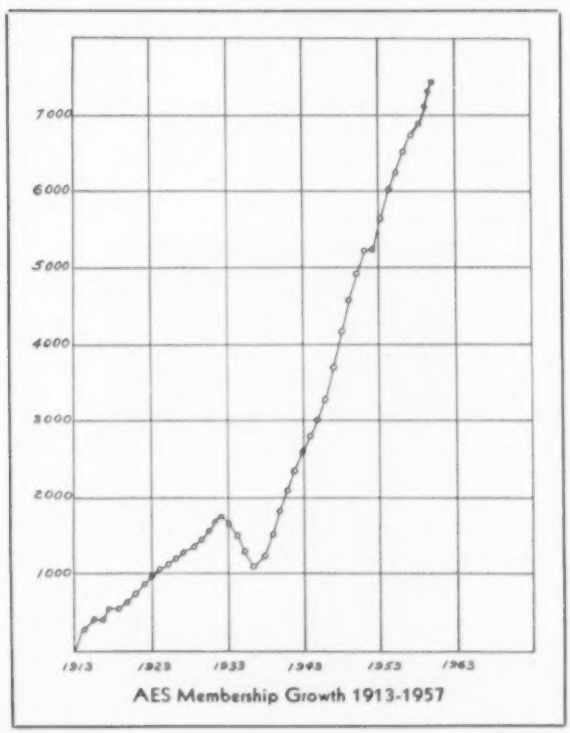
The President's report refers to the specifics of a large part of these endeavors. Considerable advance has been made in the magazine PLATING. Reorganized in its entirety during the year, the staff of PLATING should be operating at a rapid rate from now on. It is planned that the magazine will have new life and hence more appeal to readers and advertisers alike.

A separate committee on Electroplating Courses has been set up under Dr. Dodd Carr. The potential of this coordinating effort should be apparent in the next few years.

"Technical Proceedings" containing the 42 papers presented at the Washington Convention was published in record time. Branch Speakers' lists were issued in the summer of 1956.

The Executive Board has made recommendations to the Supreme Society concerning the Educational Committee. of which the First Vice President is presently Chairman.

A strong effort has been made to intensify the Society's coverage of Organic Finishing. This is to be done in view of the Society's aims and main purpose of educational activities in the plating field.



AES Membership Growth 1913-1957

Francis T. Eddy

During the past year, many Branch and Regional Meetings have been attended. Executive Board Meetings, heavy correspondence and many personal contacts have been carried out. All of these have kept your officers well informed on Society business.

All of the activities have been interesting and, it is hoped, helpful to the Society as a whole. A great deal of work, naturally, remains for the officers who will take over in June. Your continued support of and interest in their activities will build a stronger AES for the future.

SECOND VICE PRESIDENT'S REPORT

by
Herberth E. Head

YOUR Second Vice President, as prescribed in the Bylaws, is Chairman of the Membership Committee. To this end, I have given of my talents unceasingly in helping the Branches in their efforts to increase their memberships.

The help of our Members-at-Large has been solicited in the campaign to increase our membership, with most gratifying results. It would be a little premature to attempt to predict at this time the outcome of their endeavors. Suffice to say, there is evidence of genuine interest aroused which certainly should bear fruit in the near future.

During this past year, two new Branches have been added to our Society—Miami Branch (Florida) and the Vancouver Branch (British Columbia, Canada). This brings the number of Branches in Canada to five and total Branches of the Society to fifty-six.

Overall figures reveal a gain in membership during the past year. While this is encouraging, it is no trivial matter to note the loss of so many old members. While some were lost in death, as shown in the accompanying Necrology, it is disturbing to see so many lost by suspension. These people must have been interested in the

Herberth E. Head

objects of the Society—else, they would not have become members. It is possible that with a little additional effort on the part of the Membership Committees of the Branches, a goodly number of these old members could be retained as members. It is my sincere hope that we may, in some way, find a means to minimize this problem.

I submit, with this report, a graph showing the almost constant growth of your Society. While the strides with which we have grown are not alarming, it certainly indicates a healthy condition.

The following Branches are winners of the Membership Promotional Awards:

Branches with 126 or more members:
Newark, New Jersey
Branches with 70 to 125 members:
St. Joseph Valley
Branches with 69 or less members:
Mississippi Valley

Congratulations and more power to the Membership Committees of these Branches.

It might be of interest to mention that prospects are bright for the formation of two or more Branches during the coming year.

I have attended all the meetings of the Executive Board and many Branch meetings other than my home Branch, Detroit. I have attended all the meetings of Detroit Branch, including the various committee meetings held during the past year.

I want to thank all the Branches for their splendid cooperation in promoting the growth of our Society and, in particular, the members of the Branches I have had the pleasure to visit for the wonderful cooperation extended by them.

I wish to further thank the entire membership for being given the opportunity to serve the Society on the Executive Board.

THIRD VICE PRESIDENT'S REPORT

by
Ralph D. Wysong

The Third Vice President of your Society has, as his first responsibility, the job of acquainting himself with all the extensive and thorough workings of the Executive Board and the Society as a whole.

To the neophyte and the uninitiated, it seems almost impossible that so much could be and is done by so small a group, but one soon learns that the senior members of the Executive Board are a group of dedicated men. The dedication of one's self, time, energy and a great deal of your employer's time is necessary if a good job is to be done. These senior members of the Executive Board and our efficient and competent Executive Secretary have set a good example for the junior member.

Attendance at all the regular and called meetings of the Board and the Interim Meeting at Pittsburgh has helped give us a good first-year's education. Visiting numerous Branches at their annual and regular meetings has also broadened our view of the Society.

As a special assignment, our President appointed me chairman of the Organic Finishing Committee whose duty it was to find out what our membership desired concerning this subject, and to help with the March issue of PLATING which had Organic Finishing as its theme.

Numerous letters were written to a cross section of our membership asking their opinion on the subject, and a compilation of these letters was reported at the Interim Meeting in Pittsburgh. It was suggested that the individual Branches schedule one or more meetings during the year on the subject and that one session of the Annual Convention be so planned. The Educational Committee was also asked to form a subcommit-

Ralph D. Wysong

tee whose duty would be to see that desirable speakers' names were added to the Speakers' List. We attended the first dual meeting of the Milwaukee Branch and reported its success to the President and the other Board members.

It has been a privilege and an honor to serve the Society this past year, and we sincerely hope that the membership will always be aware of the fact that the elected officers welcome and solicit your suggestions and ideas. After all, this is your Society and it can only be what the Branches and members make it.

PAST PRESIDENT'S REPORT

by
Clyde Kelly

MY ONE regret in leaving the Executive Board is that I will not so often meet the many dedicated people who serve the Society in various capacities.

The demands on the time of those who serve a five-year term on the Executive Board are very great. Those Executive Board members who conscientiously perform their duties must either neglect their own businesses or that of their employer. During the time I have served on the Board, I have devoted almost all of my spare time and much of my company's time to Society matters.

It is hoped that the Delegates, by adopting a better governing set-up, will make serving the Society less burdensome. If this is not done, the Society will have administrative affairs handled by employes of large corporations who may be spared from their duties as part of the public relations scheme. The founders of the Society never intended that this should be.

I leave the board happy in the knowledge that our Headquarters' office is in charge of an extremely competent business man, John P. Nichols. John's quick grasp of the operation of the Society has amazed me. I have been very favorably impressed by his ability to get things done, and his original and sound ideas. To outsiders, the Executive Secretary is the one who represents the Society—they form their opinion of us through contacts with him. These people speak very highly of John. We should give our Executive Secretary the broadest possible latitude in handling matters properly within his domain.

In order that the Branches may be properly informed of the Executive Board's actions, they should demand that copies of the Board's meeting minutes be sent to the Branch secretaries. During the time I have been on the Board, there has been no discussion at a Board meeting which should not have been fully publicized; in fact, much damage to the Society might have been avoided if this had been done.

I urge the Delegates to be vigilant in the performance of their duties—they are the real rulers of the Society.

During the time I have served on the Executive Board, I have done those things which I felt were solely for the good of the Society. Some decisions which I have made may not have pleased everyone. I offer no apologies.

The American Electroplaters' Society will grow and prosper in proportion to the efforts and attention of its members.

In Memoriam

The Society mourns the loss of the following members who passed away during the year. Their devotion to the Society and their contributions to its progress will long honor their memory.

Baltimore-Washington Branch: L. G. Tubbs
Boston Branch: J. Alcide Beaumier; Robert Blair; Arthur Mintie
Bridgeport Branch: William Ehrencrona; Howard G. Rice
Buffalo Branch: Erwin Easton
Chicago Branch: Bruce B. Belke; C. H. McComb
Cleveland Branch: A. W. Korb
Dallas-Fort Worth Branch: Claude Hamrick
Detroit Branch: Frederic W. Wagner
Grand Rapids Branch: William Fitzsimmons; J. J. Haney
Hartford Branch: Stuart R. Begg
Lancaster Branch: J. Walter Miller
Los Angeles Branch: Harry B. Bailey; D. M. Eldred; George W. Slomin
Milwaukee Branch: Frank J. Marx; Jacob Mueller
Montreal Branch: G. Bloxall; J. J. Roche
Newark Branch: Frank P. Barile
New York Branch: Harvey Miller
Philadelphia Branch: E. T. Homan
Pittsburgh Branch: Wilfred S. McKeon
Providence-Attleboro Branch: Dr. Albert Claflin; Edward C. Garabedian
Rochester Branch: Henry Burns; George G. Rehberg
San Francisco Branch: Samuel Herrick
Waterbury Branch: Allan D. Chabot
Member-at-Large: Robert Sinclair

Clyde Kelly

EXECUTIVE SECRETARY'S REPORT

by

John P. Nichols

CONTINUING the moderate but constant growth in stature that has marked its 48-year life to date, the American Electroplaters' Society (AES) ended its 1956–1957 fiscal year on April 1, 1957 with an aggregate global membership, in all ramifications, numbering 7521 members compared with 7101 that same date the year before.

It made operational advances, moreover, that reflected themselves in improved financial result.

As against a consolidated "expense over income" deficit totaling $8,470.47 for the fiscal year ended April 1, 1956 to be specific, the AES, despite a record volume of versatile, quality output, concluded its 1956–1957 fiscal year on April 1, 1957 with a consolidated "income over expense" surplus amounting to $19.21.*

It is noteworthy that to accomplish this, AES had to absorb not only unanticipated Headquarters' reorganizational expense and the necessarily greater cost of publishing the 1956 Edition of "Technical Proceedings" but also the unexpected, unbudgeted cost of an Interim Meeting of the Supreme Society held in Pittsburgh, Pennsylvania, in January 1957, including the expense of preparing, publishing and distributing its proceedings.

The foregoing record is lucidly illustrated by the following simple Table:

	Income	
	1955–1956	*1956–1957*
Society	$ 34,776.36	$ 35,037.41
PLATING	168,382.47	176,598.56
	$203,158.83	$211,635.97

	Expense	
	1955–1956	*1956–1957*
Society	$ 48,613.15	$ 58,904.56
PLATING	163,016.15	152,712.20
	$211,629.30	$211,616.76

Materially, the AES also gained the asset of an almost entirely new, handpicked, National Headquarters' staff. Compact, coordinated, qualified but naturally not yet fully developed, it nevertheless has already demonstrated itself by the quantity and quality of its output since June 1956, start of your incumbent Executive Secretary's tenure.

RAMIFICATIONS OF AES MEMBERSHIP

As the AES ended its 1956–1957 fiscal year on April 1, 1957 enroute to its Golden Anniversary that will be observed in 1959, its Active Members numbered 6966 as against 6550 on April 1, 1956. They compose the muscle and sinew of 56 dedicated, autonomous Branches in the U. S. A., Canada and Australia that are, in turn, synchronized and serviced by National Headquarters. The British Columbia and the Miami (Florida) Branches, permanently chartered in 1957, are the latest Branches. A number more are seemingly in the offing. Branches are the veritable dynamic force of the Society.

Meshed with these Active Members at Branch level are the Society's Student Members, today's apprentices who expectedly will be tomorrow's AES leaders.

At fiscal year-end, moreover, the AES family also included 216 Members-at-Large as against 210 a year ago. These reside globally and profited from PLATING and other AES publications and services.

The Society's membership also included 339 Sustaining Members as against 341 on April 1, 1956. Composed of prominent American and Canadian industrial

* The complete certified audit report for the fiscal year ended March 31, 1957, prepared by the independent certified public accounting firm of Clyde Zukswert & Co., will be sent to all Branch Presidents, Branch Secretaries, Delegates/Alternates and Past Presidents in advance of the Annual Meeting and will also appear in the kits of all Delegates/Alternates at the Meeting. It will be published in full in the July issue of PLATING magazine.

Rodney Leeds
Editor

Mrs. Ann Marsh
Office Manager

Thomas W. Lowe
Production Manager

companies, their membership fees contributed toward financing AES technical research projects conducted by the Society in American and Canadian universities and foundations under the aegis of its Research Committee. These Sustaining Members were materially benefited, in turn, by PLATING magazine, "Technical Proceedings," Serial Reports and other AES research data disseminated among them.

BRANCH COORDINATION AND SERVICING

Coordination and servicing of Branches so as, in turn, to aid them in continuing to conduct effective educational and other programs beneficial to Branch Members was a National Headquarters' function stressed and developed during 1956–1957.

Tools to this end included "Branch Officers' Manual" that first appeared in consolidated mimeograph looseleaf book form early in 1957—a comprehensive Speakers' List that Branch Librarians found helpful in creating and staging interesting Branch meetings—the vaunted 1956 Edition of "Technical Proceedings" that helped to enrich the technical knowledge of the AES's membership—a current edition of the Society's Constitution and Bylaws booklet, including a supplement that, for the first time, published formalized policies promulgated by the Supreme Society—"Business Proceedings" (1956 Edition) presenting the Minutes of the June 1956 business meetings of the Supreme Society, et al.

Revived and staged in Pittsburgh, Pennsylvania, in January 1957 after a year's lapse, furthermore, the Interim Meeting of the Supreme Society drew a record representation of 25 Branches. Not only did the meeting provide opportunity to Delegates/Alternates to consider and debate many subjects of wide membership interest but the book "Proceedings: Fourth Interim Meeting," published and distributed after that meeting, has also given the Society's National and Branch leaders study material that will enable them to participate even more effectively in the deliberations of the Supreme Society at its business meetings at the 44th Annual Convention.

All National Officers shared, moreover, in the pleasant duty of visiting Branches. Though this year's extraordinary demands of National Headquarters' affairs necessarily limited his Branch itinerary, your Executive Secretary, nonetheless, managed to visit a

John P. Nichols

number of Branches during his ten-month tenure to date, including Detroit, Chicago, Pittsburgh, New York, Southeastern and others. At some of these, he showed "The Slide Story of the AES" created this year.

INTERNAL AND EXTERNAL PUBLIC RELATIONS

Assisting the Executive Board in spearheading a sound National program in behalf of the Society, its Branches and its members are a number of Standing Committees, including the Editorial Board, the Research Committee and others. These are supplemented by a number of functional Special Committees such as the Law Committee, the Credentials Committee, many others. In addition, the AES is represented on many intersociety groups by liaison representatives appointed by the President. The leadership and personnel of these Boards and Committees are listed elsewhere in this Annual Report with appreciation for well-done work in behalf of the Society in 1956–1957.

In the performance of their functions, these Standing and Special Committees were given full aid and cooperation by National Headquarters. In addition, the National Office developed and cemented a sound, mutually helpful relationship not only with companies and individuals dealing with it but also with a number

Miss Vera B. O'Shea
Office Accountant

Harry A. Johnston
Advertising Manager

Mrs. Loretta Ehrhardt
Advertising

of Societies and Associations having kindred interests. Compatibility and mutuality enhance cooperation—effective cooperation enhances prestige. The AES Branch and the AES member was and is the ultimate beneficiary of enhanced AES reputation and of resultant greater good will, priceless end-result of practical public relations.

PLATING MAGAZINE'S TARGETED PROGRESS

Assisted by an effective Editorial Board, the quality of PLATING has been further improved. Balance as to content, meaning the accommodation of the readership desires of the widest possible segment of the Society's members, is now, more than ever, PLATING's firm policy and goal. Experts with demonstrated professional qualifications are manning its editorial, production and advertising positions and are participating in the planning and creation of respective issues that are alive, imaginative, correct and effective. Careful budgeting and cost control are providing sound financial management. Compared with an over-all print order of 9170 copies on April 1, 1956, PLATING's over-all order numbered 9500 on April 1, 1957.

An important result of pre-planning and follow-up is the growing reservoir of technical papers that either have already been reviewed and scheduled for specific future PLATING issues or are in the process of preparation as this is written. Regardless of this improved estate, however, there is continued need, of course, for unrelaxed effort to inspire the creation and availability, for PLATING publishing consideration, of worthy original papers furthering technical and scientific knowledge. PLATING's pioneer authors' guide titled, "AES Publishing Specifications for Authors" and published, for the first time, in January 1957 has already justified itself by its accepted value to PLATING authors.

As but one element in PLATING's more focused effort to stimulate advertising, the prominent firm of Bob Wettstein & Associates of Los Angeles has been appointed Western Advertising Representative to cultivate PLATING advertising in ten Western States. Another stimulus is expected to be its new Market File and Data book.

Charles B. Niebling
Member of the prominent law firm of Lum, Fairlie and Foster of Newark, N. J., General Counsel of the AES.

HEADQUARTERS AND THE RESEARCH PROGRAM

Under the direction of a seasoned Research Committee, buttressed by an effective network of supervisory echelons, the AES's broad Research Program in universities and foundations here and in Canada has had a creditable year of performance as described elsewhere in this Annual Report by its chairman.

Aside from your Executive Secretary's service as Secretary-Treasurer of that Program, National Headquarters has played a large role in the dissemination of research information, particularly in the preparation and wide dissemination of Serial Reports and other research data. In addition, it has responsibly serviced Sustaining Members.

Prominent in the year's work was the publication of a Research Committee feature in May 1957 PLATING. Conceived by your Executive Secretary and creditably prepared by the Research Committee itself under the leadership of its chairman and its vice chairman for Research, the feature was well received.

HEADQUARTERS AND THE 1957 MONTREAL CONVENTION

Among the many tools for self-betterment provided to its members by the AES and its 56 Branches is a well-planned, popularly priced, versatile Annual Convention. This year's 44th Annual Convention is an example of effective cooperation among an enthused, experienced Host Branch—an industrious Convention Committee dynamically led—an inspired Editorial Board that provided alert supervision and direction to the fashioning of educational sessions—and, finally, National Headquarters that extended expert promotion, publicity and other specialized assistance.

As a result, it is expected that when Superintendent E. Brakefield-Moore of the Royal Canadian Mounted Police, via his welcome to Canada and Montreal at the opening session, lifts the curtain on the Society's 44th Annual Assembly, the Convention will prove to be one of the most fruitful AES general meetings in the Society's long convention history.

RECAPITULATION

In purposely sketchiest highlight, the foregoing is the profile of AES National Headquarters during the ten-month tenure to date of your incumbent Executive Secretary. In recapitulating this arduous period of simultaneous progress while building, this can be said.

Currently, the AES has a Headquarters' staff numbering thirteen handpicked men and women. Policies and procedures affecting them are enunciated in a succinct but articulate pioneer Office Manual.

The Staff includes Rodney Leeds, PLATING's able, highly qualified Editor—Harry A. Johnston, Advertising Manager, equipped with a 31-year magazine advertising record, including some seven years as Advertising Director of the official journal of the American Society of Electrical Engineers—Thomas W. Lowe, Production Manager, with a background of some fourteen years' experience as production executive of top publications of the McGraw-Hill Publishing Company.

It includes Miss Vera B. O'Shea, Office Accountant and your Executive Secretary's financial right arm, a

recently added expert with a broad corporate accounting record spanning many years.

It includes indefatigable Mrs. Ann Marsh, Office Manager and head of the Membership Division, and Mrs. Loretta Ehrhardt, administrative keystone of the Advertising Division, each of whom, having top AES longevity, has wide knowledge of the AES, its Branches, its membership. It has others, newer but qualified, who are earning growing respect as AES assets.

Since June 1956, Staff has produced a record quantity of quality output valuable and beneficial to the members of the Society and to its Branches.

Significantly, its record was made while the AES itself ended its 1956–1957 fiscal year on April 1, 1957 with a consolidated "income over expense" surplus of $19.21 compared with an $8,470.47 deficit a year ago. It was made while the Society's aggregate membership, in all classifications, mounted from 7101 as of April 1, 1956 to 7521 as at April 1, 1957.

This, therefore, is the AES record written in 1956–1957 in company with National Officers, Branches, Standing and Special Committees and other stalwarts of this mature and growing educational Society for the advancement of the science of electroplating, metal finishing and allied arts.

RESEARCH CHAIRMAN'S REPORT

by
Arthur H. DuRose

INTRODUCTION

The present organization of the Research Program is now entering its thirteenth year of activity. In retrospect, the Society and the originators of this program should feel proud of the foresight and planning which went into this organization and its aims. The objective of the program is the same as that of the society—the advancement of the science of electroplating, the finishing of metals and allied arts. The organization and the program are unique and versatile.

An attempt has always been made and continues to be made to strike a logical balance between applied and basic research. As the years pass, the emphasis may shift, indicating the advance of plating from an art to a science. However, even practical research must be performed in a scientific manner and basic research will eventually have a practical effect.

GENERAL STATUS

The work of and the results from many of the projects are of an enriching nature, both from a practical and a theoretical viewpoint.

For most of the year there have been nine active Projects. Two of these recently have been terminated. Three of the Projects are very new; two, however, are already active in actual experimentation, and the other very active in surveying the literature and designing and assembling equipment. Table I gives the pertinent information concerning the status of the present Projects.

PROJECT SUMMARIES

While the membership may receive information from the projects by way of papers in PLATING, the "Proceedings" and serial reprint form, it has recently been the practice for the Sustaining Members also to receive the Quarterly Report of the Vice Chairman, Research. In spite of this, it is felt that many individual and Sustaining Members are not well informed about the work of the Research Program. One reason is the lack of time to read all of the reports and papers. For this reason the May issue of PLATING was devoted almost entirely to short summaries of results from the past and present projects. It is hoped that these summaries will have the desired effect, not only of better acquainting the membership with the past and present work but also of creating a greater interest in the Research Program.

The asembly of this Summary Issue required much time and effort on the part of the project personnel, Headquarters, and the Research Committee; possibly, to some extent, at the expense of normal duties.

PUBLICATIONS AND RESEARCH REPRINTS

During the past year, four papers appeared in the 43rd Annual "Technical Proceedings" and two in PLATING. The number of research papers in PLATING has been reduced since they no longer appear in both PLATING and the "Proceedings."

The Committee has recently surveyed the publication status of all projects and it appears that a large

Arthur H. DuRose

number of new papers will soon be available for publication. In addition, the Committee and the editor are now arranging for the printing and binding of about seven Serial Reprints.

PRESENT STATUS OF RESEARCH PROJECTS

PROJECT 5—Effect and Removal of Impurities in Plating Solutions.

Two papers were presented at the Washington Convention on the Effect and Removal of Manganese and of Aluminum From Nickel Solutions. A similar paper on Calcium has appeared in PLATING and this completes the work on impurities by this Project. In general all three of these elements in concentrations as normally found as impurities have very little effect. In the case of aluminum and calcium at saturation, the effect was to cause slight roughness. Aluminum could be removed by high *p*H treatment.

PROJECT 10—Disposal of Plating Room Wastes.

Work has been completed, and the results will soon be published, on the Destruction of Cyanide With Ozone. The reaction rate in the more concentrated solution is relatively independent of temperature, and is diffusion controlled. At concentrations below 2 ppm however, the reaction rate increases with temperature. Several possible catalysts were investigated but none seemed to affect the reaction of ozone with either cyanide or cyanate.

PROJECT 12—Cleaning and Preparation of Metals for Electroplating.

The objective of this Project during the past year has been to determine how an oxide film, on the basis metal surface, affects the electrodeposit from the standpoint of adhesion, structure and porosity. Much preliminary work was necessary in constructing the apparatus and developing the technique for obtaining a controlled oxide thickness. Tests on the effects on adhesion have begun. Tentatively, indications are that the "apparent current efficiency" decreases logarithmically with oxide thickness.

PROJECT 13—The Nature, Cause and Effect of Porosity in Electrodeposits.

This Project now has a new Fellow and work is being resumed. In the past, porosity has been studied by gas permeability, chemical tests, and radiographic or photographic methods. The current studies involve the thorough study of nickel deposits by metallographic techniques. Pores were photographed at different levels throughout the thickness of deposit. The cross section of a pore has been reconstructed, but some difficulty was experienced with the orientation of the various levels. Methods of positively indexing the specimens are being sought.

PROJECT 14—The Effect of Basis Metal Condition on Plating.

It has previously been shown by this Project that inclusions in the steel surface can be associated with corrosion failure and that silica inclusions are especially harmful. This has further been verified by a corrosion study of many types of steel, plated with nickel. The steels were then examined for size, type and distribution of inclusions, and fair correlation found to exist, even to the extent of showing that the inconsistent corrosion performance of one type of steel was due to the variations in the amount of inclusions in that steel. Some of the inclusions are removed by the methods of preparation but the silica and alumina are not.

PROJECT 15—Accelerated Corrosion Tests.

The studies on the acetic acid salt spray tests and the Corrodkote test have been intensified, especially with respect to precision and to correlation between the test and service results. While statistical methods are being used, the work could be made much easier if more truly replicate panels could be obtained. The addition of copper salts to the acetic acid salt spray solution has been explored. This combines the knowledge obtained from both the acetic acid salt spray test and the Corrodkote test. Preliminary indications are that the inclusion of copper salts may effect a reduction in the salt spray testing time. Results being obtained from this project are attracting increased attention on the part of other technical societies.

PROJECT 16—Mechanism of Electroplating.

This Project is continuing the evaluation of the earlier experimental work and preparing a report. Since this work is extremely fundamental, great care must be exercised both in the experimental work and in the interpretation of the results. To date the work has been performed with extremely pure copper sulfate solutions using several methods of testing in order to compare the results and obtain the necessary confirmation for any theories developed. The rate determining step in the deposition of copper has been shown to be the transfer of the metal ion to the electrode with the simultaneous neutralization of the two charges on the cupric ion.

PROJECT 17—Microthrowing Power.

Since the arrival of the new Fellow, this Project has become very active. Some work has been performed using bundles of copper wires and plating into the end of the bundle. Upon disassembly the depth of penetration of the deposit into the pores between the wires can be measured. Although this system shows some promise, the Project Committee is not satisfied that this is the best method of studying microthrowing power and they are actively exploring possible better systems.

PROJECT 18—Mechanical Finishing of Metal Surfaces.

This Project is continuing its preliminary work on designing the proper equipment and organizing the research plans. The first draft of the Bibliography has been completed and the Critical Review is being assembled. A Glossary of Terms is being prepared as well as a description of buffs. Since it will take some time to obtain the proper equipment, all of the preliminary work should be out of the way, and rapid progress expected, when the equipment is obtained and installed.

CURRENT AND FUTURE PLANS

While some projects exceeded their individual budgets, it is evident from the overall standpoint that the

expenses are less than the budgeted amount. However, it is also evident that the income is less than anticipated. In line with the inflationary trend the cost of research is going up and it is logical to assume that it will continue to rise.

Because of the number of Projects which have been active and because of the uncertain financial status, no serious consideration has been given this year to possible new projects. Knowing however, that eventually new projects are a *must*, a subcommittee is at present reviewing past proposals and new proposals for research.

Since some of the projects did not use all of their allotted funds, there again is an excess of income over expenses and it is probable that a new project will be started in the near future. In this connection the Committee welcomes written suggestions for the institution of new research projects from the individual and Sustaining Members of the Society. The Committee also hopes that the individual member of the Society will realize the significance of a rising cost of research without a corresponding increase in the number of Sustaining Members.

It is the practice of the Research Committee to maintain a reserve fund large enough to permit continuation of all present research for a minimum of two years. This is necessary to insure the renewal and eventual completion of all projects now active. Reference to the Auditor's report shows that the Research Fund net worth at the end of the fiscal year is about $112,805.12.

CONCLUSION

This year the accomplishments of the research program have continued at the usual high rate. For various reasons the number of publications is less than has been normal, but the Committee feels that the May issue of PLATING will more than compensate for this. It is hoped that the concise summaries of practical accomplishment will be of value to the individual, the Sustaining Member, the Society, and thereby the plating industry.

In closing this report, your Chairman and the entire Committee wishes to thank the District Supervisors, Project Committee Members, Directors and Fellows, and the Sustaining Members for making this year's research accomplishments possible. It has been a lot of work, but enjoyable.

TABLE I

SUMMARY OF AMERICAN ELECTROPLATERS' SOCIETY RESEARCH PROJECTS

Project	Location	Project Director	Committee Chairman	Fellow	Subject	Status
5	Michigan State	Dr. A. J. Smith	L. C. Borchert	R. Bacon	Effect and Removal of Impurities in Nickel Solutions	Recently Inactivated
10	Yale	Dr. B. Dodge	L. Durney	N. E. Sondak	Disposal of Plating Room Wastes	Recently Inactivated
12	Columbia	Dr. H. B. Linford	E. T. Candee	D. Feder A. Venkateswarlu	Cleaning—Oxide Effects	Active
13	Bureau of Standards	F. Ogburn	C. Sample	Dr. D. Ernst	Nature, Cause and Effect of Porosity in Electrodeposits	Active
14	Ontario Research Foundation	Dr. N. H. Jones	W. Tucker	J. Zajdowski	Effect of Basis Metal Conditions on Plating	Active
15	Detroit Area	None	W. L. Pinner	None needed	Accelerated Corrosion Tests	Active
16	University of Pennsylvania	Dr. J. O'M. Bockris	E. Bowerman	Dr. W. Mehl	Mechanism of Electrodeposition	Active
17	Virginia Institute for Scientific Research	Dr. H. Leidheiser	Dr. W. Meyer	Dr. K. Killer	Microthrowing Power	Active
18	Chicago Area	None	C. E. Kennedy	None needed	Mechanical Finishing of Metal Surfaces	Active

AES BOARDS AND COMMITTEES

I. STANDING BOARDS AND COMMITTEES

1. Credentials Committee
   - Fred Fulforth, Metal & Thermit, Chairman
   - George Schore, Rapid Electric Co.
   - C. F. Nixon, General Motors Corp.

2. Editorial Board
   - John P. Nichols, Chairman
   - Rodney Leeds, Secretary
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   - Philip M. Coady, Rediweld (Canada) Ltd.
   - S. Lewis Doughty, Lea Manufacturing Co.
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   - Arthur W. Logozzo, Nutmeg Chrome Corp.
   - Howard J. McAleer, Formax Mfg. Co.
   - Robert D. Miller, Electric Auto-Lite
   - Fremont L. Scott, Metal & Thermit Corp.
   - William M. Tucker, Eastman Kodak Co.
   - Dr. Harold J. Wiesner, Bendix Aircraft

3. Educational Committee
   - Francis T. Eddy, Technicraft Laboratories, Inc., Chairman (and all Branch Librarians)

4. Employment Committee
   - John P. Nichols, American Electroplaters' Society, Inc., Chairman (and all Branch Secretaries)

5. Law Committee
   - G. W. Cavanaugh, General Electric Co., Chairman
   - Manson Glover, Glover Coating Co., Inc.

Headquarters ready for a meeting

   - Eugene Roth, Roth Plating Co.
   - William J. Neill, Columbus Metal Products

6. Membership Committee
   - Herberth E. Head, Chrysler Corp., Chairman (and all Branch First Vice Presidents)

7. Paper Awards Committee
   - Dr. Abner Brenner, National Bureau of Standards, Chairman
   - Leslie Diveley, Cutler-Hammer, Inc.
   - Lloyd O. Gilbert, Rock Island Arsenal

8. Publication Committee
   - Dr. Ralph A. Schaefer, Clevite Graphite Bronze Co., Chairman
   - Dr. Harold J. Wiesner, Bendix Aircraft, Co-Chairman
   - Dr. Earl J. Serfass, Lehigh University
   - Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Co.

9. Public Relations Committee
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   - John P. Nichols, American Electroplaters' Society, Inc., Secretary-Treasurer
   - Lewis Glassner, Glassner & Associates
   - Manson Glover, Glover Coating Co.
   - I. William Marcovitch, American Machine & Metals, Inc., U. S. Gauge Div.
   - Richard V. Morrison, O. S. Tyson Co.
   - Robert M. Norton, Hanson-Van Winkle-Munning Co.
   - Arthur G. Pierdon, Art Metal Finishing Co.
   - Frank Tirendi, The Patent Button Co.
   - R. C. Trees, Udylite Corporation

10. Research Committee
    - Arthur H. DuRose, The Harshaw Chemical Co., Chairman
    - R. A. Ehrhardt, Bell Telephone Labs., Inc., Vice Chairman, Research
    - A. P. Wrisberg, Davies Supply & Mfg. Co., Vice Chairman, Finance
    - John P. Nichols, American Electroplaters' Society, Inc., Secretary-Treasurer
    - George E. Best, Allied Chemical & Dye Corp.
    - Leslie Diveley, Cutler-Hammer, Inc.
    - Lloyd O. Gilbert, Rock Island Arsenal
    - Dr. Russel E. Harr, Western Electric Co.
    - Dr. Walter R. Meyer, Enthone, Inc.
    - Leland M. Morse, The Chrysler Corp.
    - Dr. William Blum, Consultant (Honorary)

II. SPECIAL AES COMMITTEES

1. AES Award for Scientific Achievement Committee
   - Kenneth M. Huston, Armco Steel Corp., Chairman
   - Myron B. Diggin, Hanson-Van Winkle-Munning Co.
   - Dr. Charles L. Faust, Battelle Memorial Institute
   - Dr. Walter R. Meyer, Enthone, Inc.
   - Cleveland F. Nixon, General Motors Corp.
   - Dr. Lewis Weisberg, Consultant

2. Committee on Electroplating Courses
   - Dr. Dodd Carr, Bart Manufacturing Co., Chairman
   - Ezra A. Blount, "Products Finishing," Vice Chairman
   - F. J. LaManna, Bart Manufacturing Co., Secretary
   - Fred G. Brune, Chrysler Corp.
   - Mitchell Raskin, Consultant

3. Constitution and Bylaws Revision Committee
   - Dr. George P. Swift, Watertown, Mass., Chairman
   - I. William Marcovitch, American Machine & Metals Co., U. S. Gauge Div.
   - Paul Glab, Northwestern Plating Works

4. Organic Finishing Committee
   - Ralph D. Wysong, Studebaker-Packard Corp., Chairman
   - Fremont L. Scott, Metal & Thermit Corp., Vice Chairman

5. Structure of the Society Committee
   - Leonard P. Weeg, National Lock Co., Chairman
   - George W. Cavanaugh, General Electric Co.
   - William Lindsey, Chemical Corp.
   - Arthur W. Logozzo, Nutmeg Chrome Corp.
   - William J. Neill, Columbus Metal Products, Inc.
   - John P. Nichols, American Electroplaters' Society, Inc.
   - Cleveland F. Nixon, General Motors Corp.
   - Arthur G. Pierdon, Art Metal Finishing Co.
   - Dr. George P. Swift, Consultant

III. AES LIAISON WITH OTHER SOCIETIES (Inter-Society Representatives)

1. American Society for Testing Materials (ASTM)
   - John P. Nichols, Executive Secretary American Electroplaters' Society, Inc.

   ASTM Committee A-5, Corrosion of Iron and Steel
   - August Mendizza, Bell Telephone Laboratories

   ASTM Committee B-8, Electrodeposited Metallic Coatings
   - Raymond F. Ledford, Industrial Filter & Pump Mfg. Co.

   ASTM Committee D-19, Industrial Water
   - George E. Best, Allied Chem. & Dye Corp.

   ASTM Committee B-7, Sub-Committee VI on the Anodic Oxidation of Aluminum and Magnesium Alloys
   - Fred Keller, American Society for Testing Materials

2. American Standards Association (ASA) Committee B-73 Centrifugal Pumps for Chemical Industry Use
   - Eugene L. Combs, Diamond Alkali Co.

   ASA, Committee Z-74, Performance of Effluent Air and Gas Cleaning Equipment
   - George Schore, Rapid Electric Company

   ASA, Committee Z-9, Sectional Committee on Safety Codes for Exhaust Systems
   - Myron B. Diggin, Hanson-Van Winkle-Munning Co.
   - W. R. Fidelius, Hanson-Van Winkle-Munning Co.

3. International Council for Electrodeposition & Institute of Metal Finishing
   - Dr. Walter R. Meyer, Enthone, Inc.
   - Walter L. Pinner, Detroit Division, Houdaille Industries, Inc.

4. Inter-Society Corrosion Committee
   - Dr. W. A. Wesley, International Nickel Co.

5. Metal Finishing Suppliers Association
   - Earle W. Couch, The Lea Manufacturing Co.

6. National Association of Corrosion Engineers
   - George E. Best, Allied Chem. & Dye Corp.
   - Carl O. Durbin, Alternate, Chrysler Corp.

7. National Association of Metal Finishers
   - Arthur G. Pierdon, Art Metal Finishing Co.

8. National Technical Task Committee on Industrial Wastes
   - Dr. C. Fred Gurnham, Michigan State College, Chairman
   - Dr. D. G. Foulke, Hanson-Van Winkle-Munning Co.

9. Ohio River Valley Water Sanitation Commission
   - William J. Neill, Columbus Metal Products, Inc.

10. Society for Plastic Engineers
    - Arthur W. Logozzo, Nutmeg Chrome Corp.

Typical meeting: Editorial Board, April 5, 1957

BRANCH DIRECTORY

(As of April 1, 1957)

ADELAIDE

Secretary-Treasurer: E. J. Down
17 Currie St., Adelaide, S. A., Australia
Meeting Place: 17 Waymouth St., Adelaide
Day of Month: First Friday
Sustaining Members:
None

ALLENTOWN-READING

Secretary-Treasurer: Raymond Housel
363 Warren St., Phillipsburg, N. J.
Meeting Place: Scotty's Anchorage, Emaus, Pa.
Day of Month: Fourth Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.
Sustaining Members:
Bethlehem Steel Co. (2), Bethlehem, Pa.
L. F. Grammes & Sons, Inc., Allentown, Pa.
The New Jersey Zinc Co. (of Pennsylvania) (3), Palmerton, Pa.

BALTIMORE-WASHINGTON

Secretary: Carl H. Thiede
8426 Piney Branch Rd., Silver Spring, Md.
Meeting Place: Chemistry Bldg., National Bureau of Standards, Washington 25, D. C.
and
Marling House, 20 E. Fayette St., Baltimore, Md.
Day of Month: Second Tuesday
Time: 8:00 P.M.
Sustaining Members:
Allied Research Products, Inc., Baltimore 5, Md.
American Instrument Co., Silver Spring, Md.
Atlas Powder Co., Wilmington 99, Del.
Crown Cork & Seal Co., Baltimore 3, Md.
E. I. duPont de Nemours & Co., Inc., Wilmington 98, Del.

BOSTON

Secretary-Treasurer: Dr. George P. Swift
53 Galen St., Watertown 72, Mass.
Meeting Place: Hotel Statler, Boston, Mass.
Day of Month: First Thursday
Time: Dinner 6:00 P.M.—Speaker 8:15 P.M.
Sustaining Members:
American Anodizing Corp., Quincy, Mass.
M. E. Baker Co., Cambridge, Mass.
Beacon Supply Co., Chelsea, Mass.
F. L. & J. C. Codman Co., Rockland, Mass.
United-Carr Fastener Corp., Cambridge 42, Mass.

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Secretary-Treasurer: Robert G. Parker
25 Beverly Rd., Trumbull, Conn.
Meeting Place: Hotel Barnum, Bridgeport, Conn.
Day of Month: Second Friday
Time: 8:00 P.M.
Sustaining Members:
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Mitchell-Bradford Chemical Co., Bridgeport, Conn.
Roberts Rouge Co., Stratford, Conn.
E. E. Seeley Co., Inc., Bridgeport, Conn.
Yankee Metal Products Corp., Norwalk, Conn.

BRITISH COLUMBIA

Secretary: Jim Lee
366 Three Rd., Richmond-Vancouver, B. C.
Meeting Place:
Sustaining Members:
None

*Numbers after names of Sustaining Members indicate number of memberships supported.

BUFFALO

Secretary: Fred Goeckel
139 Overbrook, Tonawanda, N. Y.
Meeting Place: Markeen Hotel, Main & Utica, Buffalo, N. Y.
Day of Month: Last Friday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.
Sustaining Members:
Van Der Horst Corporation of America, Olean, N. Y.

CAPITOL DISTRICT

Secretary: Edward V. Raymond
Broadlawn North St., Cheshire, Mass.
Meeting Place: Panetta's Restaurant, Menands, N. Y.
Day of Month: First Monday
Time: 8:00 P.M.
Sustaining Members:
General Electric Company, Schenectady, N. Y.
Sprague Electric Company, North Adams, Mass.

CENTRAL MICHIGAN

Secretary-Treasurer: E. J. Bosca
411 Third St., Jackson, Mich.
Meeting Place: Porter Hotel, Lansing, Mich.
and
Hayes Hotel, Jackson, Mich.
Day of Month: Second Tuesday
Time: 7:00 P.M.
Sustaining Members:
None

CHICAGO

Secretary-Treasurer: Paul Glab
828 N. Paulina St., Chicago 22, Ill.
Meeting Place: The Western Society of Engineers, 84 E. Randolph St., Chicago, Ill.
Day of Month: Second Friday
Time: 8:00 P.M.
Sustaining Members:
Acid Products Co., Inc., Chicago, Ill.
Acme Steel Co., Chicago 27, Ill.
Adolph Plating, Inc., Chicago 12, Ill.
Allied Industrial Products, Inc., Chicago, Ill.
American Buff Co., Chicago 16, Ill.
American Cabinet Hardware Corp., Rockford, Ill.
American Can Co., Maywood, Ill.
American Nickeloid Co., Peru, Ill.
Amphenol Electronics Corp., Chicago 50, Ill.
Apex Plating Co., Chicago 7, Ill.
Apollo Metal Works, Chicago 38, Ill.
Ardco, Inc., Chicago 38, Ill.
Arrow Plating Co., Inc., Chicago 47, Ill.
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Bastian Blessing Co., Chicago 30, Ill.
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Berteau-Lowell Plating Works, Chicago 47, Ill.
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Electro-Glo Co., Chicago, Ill.
Felt & Tarrant Mfg. Co., Chicago 22, Ill.
General American Trans. Corp., Kanigen Div., Chicago 90, Ill.
Graham Plating Works, Chicago, Ill.
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Industrial Filter & Pump Mfg. Co., Chicago 50, Ill.
Kamide Div., Kraft Chemical Co., Chicago 8, Ill.
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The Matchless Metal Polish Co., Chicago, Ill.
The Meaker Co., Chicago 50, Ill.
Mechanical Plating Co., Chicago 22, Ill.
Mercil Plating Equipment Co., Chicago 12, Ill.

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Metalcraft Corp., Chicago 10, Ill.
Metal Processing Co., Chicago 12, Ill.
The Modern Plating Co., Chicago 18, Ill.
Modern Plating Corp., Freeport, Ill.
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Northwestern Plating Works, Chicago 23, Ill.
Perma-Line Rubber Products Corp., Chicago, Ill.
Platers Technical Service, Inc., Chicago 5, Ill.
Plating Service Co., Chicago 39, Ill.
Poor & Company, Promat Division, Waukegan, Ill.
Reliable Plating Corp., Chicago 7, Ill.
Reliable Plating Rack Co., Schiller Park, Ill.
Scientific Control Laboratories, Chicago 7, Ill.
J. P. Seeburg Corp., Chicago 22, Ill.
Sparkler Mfg. Co., Mundelein, Ill.
Standard Plating Rack Company, Chicago 23, Ill.
George A. Stutz Mfg. Co., Chicago, Ill.
Sunbeam Corp., Chicago 50, Ill.
Technic, Inc., Chicago 26, Ill.
Ther Electric & Machine Works, Chicago, Ill.
Time Chemical, Inc., Chicago 9, Ill.
United Manufacturing Co., Chicago 18, Ill.
Western Electric Co., Inc., Chicago 23, Ill.
Western Rust-Proof Co., Chicago, Ill.

CINCINNATI

Secretary: David L. Kaplan
817 Sabino Court, Cincinnati 31, Ohio
Meeting Place: Engineering Society Headquarters, Cincinnati
Day of Month: Fourth Wednesday
Time: Dinner 6:30 P.M.—Meeting 7:30 P.M.

Sustaining Members:

Buckeye Products Co., Cincinnati, Ohio
Products Finishing, Cincinnati, Ohio

CLEVELAND

Secretary-Treasurer: Robert I. Peters
12901 Elmwood Ave., Cleveland 11, Ohio
Meeting Place: Hotel Carter
Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:

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Advance Plating Co., Cleveland, Ohio
Clevite Research Center, Cleveland 8, Ohio
Cowles Chemical Co., Cleveland, Ohio
Diamond Alkali Co., Chromium Chemicals Division, Cleveland 14, Ohio
Eaton Manufacturing Co., Cleveland 10, Ohio
Harshaw Chemical Co. (3), Cleveland, Ohio
Heil Process Equipment Corp., Cleveland 11, Ohio
R. O. Hull & Co., Inc., Rocky River 16, Ohio
Incor, Inc., Cleveland 8, Ohio
The Kelly Plating Company, Cleveland, Ohio
Lorence Plating Co., Cleveland 4, Ohio
The McGean Chemical Co., Cleveland 9, Ohio
National Screw & Mfg. Co., Cleveland 4, Ohio
Pittsburgh Steel Co., Cleveland 14, Ohio
Platers Supply Co., Cleveland 14, Ohio
R. W. Renton & Co., Cleveland 3, Ohio
Republic Steel Corp., Cleveland, Ohio
Rockwell Spring & Axle Co., Mishawaka, Ind.
Smoothex, Inc., Cleveland, Ohio
Talon, Inc., Meadville, Pa.

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Secretary: Halvor Christianson
2593 Andover Rd., Columbus 21, Ohio
Meeting Place: Battelle Memorial Institute, Columbus, Ohio
Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:

None

DALLAS-FORT WORTH

Secretary-Treasurer: A. C. Fricke
212 Julian St., Dallas, Texas
Meeting Place: Lennox Hotel, Grand Prairie, Texas
Day of Month: Third Wednesday
Time: 6:30 P.M.

Sustaining Member:

Lane Plating Works, Dallas, Texas

DAYTON

Secretary: Richard M. Clinehens
3206 Harwood St., Dayton 10, Ohio
Meeting Place: Hotel Biltmore, Dayton, Ohio
Day of Month: Third Wednesday
Time: 8:00 P.M.

Sustaining Members:

Dayton Rust Proof Co., Dayton, Ohio
General Motors Corp., Frigidaire Division, Dayton, Ohio
National Cash Register Co., Dayton, Ohio
Rack Processing Co., Dayton 9, Ohio
Rawac Plating Co., Springfield, Ohio

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Secretary-Treasurer: Edward J. Kubis
Wyandotte Chemicals Corp., Wyandotte, Mich.
Meeting Place: Hotel Statler, Detroit, Mich.
Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:

Alco Chemical, Inc., Dearborn, Mich.
Arted Chrome Plating Co., Detroit, Mich.
Auto City Plating Co., Detroit 17, Mich.
Automotive Rubber Co., Detroit 28, Mich.
Bruce Products Corp., Howell, Mich.
Buckingham Products Co., Detroit 27, Mich.
Chrysler Corp. (2), Detroit, Mich.
Congress Die Casting Co., Detroit 34, Mich.
Ford Motor Co. (5), Dearborn, Mich.
Formax Manufacturing Co., Detroit, Mich.
General Motors Corporation, Research Staff (5), Detroit 2, Mich.
Gerity-Michigan Corp., Adrian, Mich.
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Higgins Rack Coating & Mfg. Co., Hazel Park, Mich.
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Kaybar, Inc., Birmingham, Mich.
Knight Plating Co., Detroit 7, Mich.
Lyon, Inc., Detroit 28, Mich.
R. C. Mahoney, Detroit 11, Mich.
Master Platers, Inc., Detroit, Mich.
Metal Mouldings Corp., Detroit 28, Mich.
Metal Plating Corp., Oak Park, Mich.
Michigan Chrome & Chemical Co., Detroit 13, Mich.
Midwest Chrome Process Co., Detroit 9, Mich.
Motor Products Corp., Detroit 14, Mich.
George L. Nankervis Co., Detroit 27, Mich.
Nelson Chemicals Co., Detroit 27, Mich.
Northwest Chemical Co., Detroit 4, Mich.
Oakman Manufacturing Co., Van Dyke, Mich.
Reed Plating Company, Detroit 11, Mich.
Reilly Plating Company, Melvindale, Mich.
J. J. Siefen Co., Detroit 9, Mich.
Siefen Compounds, Inc., Detroit 38, Mich.
Solventol Chemical Products, Inc., Detroit 3, Mich.
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Frederic B. Stevens, Inc. (2), Detroit 16, Mich.
Superior Polishing Company, Van Dyke, Mich.
Superior Steel Corp., Detroit, Mich.
The Udylite Corp. (3), Detroit 11, Mich.
United Platers, Inc., Detroit, Mich.
Univertical Foundry & Machine Co., Detroit, Mich.
A. T. Wagner Co., Detroit, Mich.
Wagner Brothers, Inc., Detroit 3, Mich.
Whitefield Chemicals, Detroit 27, Mich.
Wyandotte Chemicals Corp., Wyandotte, Mich.

GRAND RAPIDS

Secretary: Edwin Krook
1008 S. Otillia, S. E., Grand Rapids, Mich.
Meeting Place: Finger's Restaurant
Day of Month: Second Friday
Time: 7:00 P.M.

Sustaining Members:

Dexter Industries, Inc., Grand Rapids 2, Mich.
Doehler-Jarvis Corp., Grand Rapids, Mich.
Expert Coating Co., Grand Rapids, Mich.
P. B. Gass Co., Grand Rapids, Mich.
Grand Rapids Plating Co., Inc., Grand Rapids 5, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., J. C. Miller Div., Grand Rapids, Mich.
Haviland Products Co., Grand Rapids, Mich.
Jervis Corp., Grandville, Mich.
Keeler Brass Co., Grand Rapids, Mich.
Knape & Vogt Mfg. Co., Grand Rapids, Mich.
Michigan Plating & Stamping Co., Grand Rapids 2, Mich.
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Precision Castings Company of Michigan, Kalamazoo, Mich.
Preston Products Co., Grand Rapids 4, Mich.
Roto-Finish Company, Kalamazoo, Mich.

HAMILTON

Secretary: B. C. Teal
16 Wilton St., Port Nelson, Ontario, Canada
Meeting Place: Fischer's Hotel, Hamilton
Day of Month: Third Friday
Time: 8:15 P.M.

Sustaining Members:

Behr-Manning, Ltd., Brantford, Canada
Dominion Foundries & Steel, Ltd., Hamilton, Ontario, Canada
The Steel Company of Canada, Ltd., Hamilton, Ontario, Canada
Westinghouse Corporation of Canada, Ltd., Hamilton, Ontario, Canada

HARTFORD

Secretary: Stanley Platoz
26 Erwin Place, New Britain, Conn.

Meeting Place: Hotel Bond

Day of Month: Third Monday
Time: 7:45 P.M.

Sustaining Members:

Arrow Hart & Hegeman Electric Company, Hartford 6, Conn.
New England Plating Co., Inc., Worcester, Mass.
Nutmeg Chrome Corporation, West Hartford 10, Conn.
Royal Typewriter Company, Hartford, Conn.
The Stanley Works, New Britain, Conn.

HOUSTON

Secretary-Treasurer: Ralph A. Marz
2903 W. Dallas, Houston, Texas

Meeting Place: Ben Milam Hotel

Day of Month: Third Tuesday
Time: 7:00 P.M.

Sustaining Member:

Dixie Electro Plating Company, Houston 3, Texas

INDIANAPOLIS

Secretary: Paul B. Freeman
316 N. Wallace St., Indianapolis, Ind.

Meeting Place: Fox Steak House, 1207 E. Washington St., Indianapolis, Ind.

Day of Month: First Wednesday
Time: Dinner 6:30—Meeting 8:00 P.M.

Sustaining Members:

Arvin Industries, Inc., Columbus, Ind.
P. R. Mallory & Co., Indianapolis, Ind.

KANSAS CITY

Secretary: Olin Bock
5317 W. 58th St., Mission, Kansas

Meeting Place: Berkshire Hotel

Day of Month: Second Thursday

Sustaining Members:

None

LANCASTER

Secretary-Treasurer: Robert Plaisted
Schick, Inc., Lancaster, Pa.

Meeting Place: Varies

Day of Month: Second Friday
Time: 8:00 P.M.

Sustaining Members:

American Wire Fabrics Corporation, Mt. Wolf, Pa.
Hamilton Watch Company, Lancaster, Pa.

LOS ANGELES

Secretary: Emmett H. Babcock
1308 E. Alvarado, Pomona, Calif.

Meeting Place: Roger Young Auditorium, 926 W. Washington Blvd., Los Angeles, Calif.

Day of Month: Second Wednesday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Members:

Alert Supply Company, Los Angeles 22, Calif.
Associated Plating Co., Los Angeles, Calif.
The Barber-Webb Co., Inc., Los Angeles 58, Calif.
L. H. Butcher Co., Los Angeles 23, Calif.
Crown City Plating Co., Pasadena, Calif.
Hall Mack Company, Los Angeles 7, Calif.
Mefford Chemical Co., Los Angeles 22, Calif.
Millhorn Chemical & Supply Co., Los Angeles 1, Calif.
Modern Plating Co., Los Angeles, Calif.
George E. Nichols Plating, Los Angeles, Calif.
North American Aviation, Inc., Los Angeles 45, Calif.
Price Pfister Brass Mfg. Co., Los Angeles 31, Calif.
Rheem Automotive Co., Los Angeles, Calif.
Standard Nickel Chromium Plating Co., Los Angeles, Calif.
Sundmark Supply Co., Los Angeles, Calif.
Surface Alloys Engineering Co., Huntington Park, Calif.
Turco Products, Inc., Los Angeles 54, Calif.
Virtue Brothers Mfg. Co., Los Angeles 45, Calif.

LOUISVILLE

Secretary-Treasurer: Joseph G. Sterling
6025 Peggy Drive, Louisville 13, Kentucky

Meeting Place: Kapfhammers Party House, 1506 S. Shelby St., Louisville, Kentucky

Day of Month: Third Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Member:

American Radiator & Standard Sanitary Corp., Louisville, Ky.

MELBOURNE

Acting Secretary: P. Major
c/o Glen Walker & Co. Pty., Ltd., 11 Waterloo St., Carlton, Australia

Meeting Place: Metallurgy Theatre, Royal Melbourne Tech. College

Day of Month: Third Thursday
Time: 8:00 P.M.

Sustaining Members:

None

MIAMI

Secretary: A. F. Newlander
2201 S. W. 81st Ave., Miami 44, Florida

Sustaining Members:

None

MILWAUKEE

Secretary-Treasurer: Sy Taterczynski
3463 N. Dousman St., Milwaukee, Wisc.

Meeting Place: Ambassador Hotel, Milwaukee, Wisc.

Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:

Acme Galvanizing, Inc., Milwaukee 15, Wisc.
Allen Bradley Co., Milwaukee 4, Wisc.
Cutler-Hammer, Inc., Milwaukee, Wisc.
Donald Sales & Mfg. Co., Milwaukee 13, Wisc.
Kohler Co., Kohler, Wisc.
Line Material Co., South Milwaukee, Wisc.
Milwaukee Plating Co., Milwaukee 12, Wisc.
John Oster Mfg. Co., Milwaukee 17, Wisc.
Parker Pen Co., Janesville, Wisc.
Perlick Brass Co., Milwaukee, Wisc.
Plating Engineering Co., West Allis 14, Wisc.
Racine Plating Co., Inc., Racine, Wisc.
Square D Company, Milwaukee 12, Wisc.
S. K. Williams Co., Milwaukee 10, Wisc.

MISSISSIPPI VALLEY

Secretary-Treasurer: John Hartman
623 W. 31st St., Davenport, Iowa

Meeting Place: Tower Restaurant, 7th St. & 30th Ave., Moline, Ill.

Day of Month: Third Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:

American Metal Finishing Co., Canton, Miss.
Victor Casket Hardware Co., Galesburg, Ill.

MONTREAL

Secretary-Treasurer: William T. Scott
1430 Dutrisac St., Apt. 5, St. Laurent, Montreal 9, P. Q.

Meeting Place: Mount Royal Hotel, 1455 Peel St., Montreal, P. Q.

Day of Month: First Monday
Time: 8:30 P.M.

Sustaining Members:

Alloycraft, Ltd., Westmont, Montreal, Canada
Northern Electric Co., Ltd., Montreal, Quebec, Canada
Union Screen Plate Co. of Canada, Ltd., Lennoxville, Quebec, Canada

NEWARK

Secretary: D. Gardner Foulke
455 Johnston Drive, Watchung, Plainfield, N. J.

Meeting Place: Robert Treat Hotel

Day of Month: Third Friday
Time: 8:15 P.M.

Sustaining Members:

American Smelting & Refining Co., South Plainfield, N. J.
Bell Telephone Laboratories, Murray Hill, N. J.
Corona Corp., Jersey City, N. J.
Finishing Publications, Inc., Westwood, N. J.
Frederick Gumm Chemical Co., Kearny, N. J.
Hanson-Van Winkle-Munning Co. (3), Matawan, N. J.
Hy Grade Electro Plating Co., Newark 7, N. J.
Maas & Waldstein Co., Newark 4, N. J.
Royal Plating & Polishing Co., Inc., Newark 4, N. J.
Sel-Rex Corporation, Nutley 10, N. J.

NEW HAVEN

Secretary-Treasurer: Bernard J. Gaffney
40 Filbert St., Spring Glen, Hamden 14, Conn.

Meeting Place: Mason Laboratory—Yale University

Day of Month: Second Tuesday
Time: 8:00 P.M.

Sustaining Members:

Christie Plating Company, Groton, Conn.
Chromium Process Co., Shelton, Conn.
Enthone, Inc., New Haven 2, Conn.

NEW YORK

Secretary-Treasurer: Milton Nadel
905 162nd St., Whitestone 57, N. Y.

Meeting Place: Hotel Statler

Day of Month: Second and Fourth Fridays
Time: 8:00 P.M.

Sustaining Members:

Allied Chemical & Dye Corp., Mutual Chem. Div., New York 16, N. Y.
Allied Chemical & Dye Corp., National Aniline Div., New York 6, N. Y.
American Zinc Institute (5), New York, N. Y.
Chromium Corporation of America, New York 17, N. Y.
International Nickel Company, Inc. (5), New York, N. Y.
Lea-Ronal, Inc., Jamaica 35, N. Y.
Levco Metal Finishers, Inc., Long Island City 1, N. Y.
Magnuson Products Corp., Brooklyn 2, N. Y.
Metal & Thermit Corp. (2), New York 17, N. Y.
Oakite Products, Inc., New York 6, N. Y.
Richardson-Allen Corp., College Point, L. I., N. Y.
Sylvania Electric Products, Inc., Flushing, N. Y.

PHILADELPHIA

Secretary: I. William Marcovitch
1302 St. Vincent St., Philadelphia 11, Pa.

Meeting Place: Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia 7, Pa.

Day of Month: Fourth Monday
Time: 8:00 P.M.

Sustaining Members:

Accurate Electro-Plating, Inc., Philadelphia, Pa.
Aetna Electroplating Co., Inc., Philadelphia 11, Pa.
American Chemical Paint Co., Ambler, Pa.
General Plating Co., Trenton, N. J.
Graham, Crowley & Associates, Inc., Jenkintown, Pa.
Leeds & Northrup, Philadelphia 44, Pa.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Philadelphia Rust Proof Co., Philadelphia 34, Pa.
Philco Corp., Philadelphia 34, Pa.
Progress Mfg. Co., Inc., Philadelphia 34, Pa.
Radio Corporation of America, Camden 2, N. J.
The Reynolds Co., Philadelphia 32, Pa.
Steel Heddle Manufacturing Co., Philadelphia 32, Pa.

PITTSBURGH

Secretary: F. W. Stevens
Mounted Route No. 7, Elwood City, Pa.

Meeting Place: Gateway Plaza, Pittsburgh, Pa.

Day of Month: First Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:

Aluminum Company of America, New Kensington, Pa.
Rockwell Spring & Axle Co., Standard Steel Spring Div., Coraopolis, Pa.
Weirton Steel Co., Weirton, West Va.
Westinghouse Electric Corp., East Pittsburgh, Pa.

PORTLAND

Secretary-Treasurer: Dale Tweed
3950 N. W. Yeon Ave., Portland, Oregon

Meeting Place: Varies

Day of Month: Second Tuesday
Time: 6:00 P.M.

Sustaining Members:

None

PROVIDENCE-ATTLEBORO

Secretary: F. L. Sherman
17 Hillsdale Drive, Cranston 10, R. I.

Meeting Place: Providence Engineering Society Building, 195 Angell St., Providence, R. I.

Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:

Gorham Manufacturing Co., Providence 7, R. I.
Walton & Lonsbury, Attleboro, Mass.

ROCHESTER

Secretary-Treasurer: Linwood Morrison
1240 Weiland Rd., Rochester 13, N. Y.

Meeting Place: 40 & 8 Club, 933 University Ave., Rochester, N. Y.

Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:

Eastman Kodak Co. (2), Rochester 4, N. Y.
Stromberg-Carlson Co., Rochester, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Wollensak Optical Co., Rochester, N. Y.

ROCKFORD

Secretary-Treasurer: E. J. Budden
122 12th St., Rockford, Ill.

Meeting Place: Faust Hotel, Rockford, Ill.

Day of Month: Second Monday
Time: 7:00 P.M.

Sustaining Member:

National Lock Co., Rockford, Ill.

SAGINAW VALLEY

Secretary: Douglas T. Rewbotham
616 E. Baker St., Flint 5, Michigan

Meeting Place: Zehnder, Frankenmuth, Michigan

Day of Month: Second Wednesday
Time: 7:00 P.M.

Sustaining Members:

None

ST. JOSEPH VALLEY

Secretary-Treasurer: Henry A. Meers
2001 Bergen St., South Bend, Ind.

Meeting Place: Lincoln Highway Inn, Mishawaka, Ind.

Day of Month: First Wednesday
Time: Dinner 6:30 P.M.—Technical Session 8:00 P.M.

Sustaining Members:

Bendix Aviation Corp., Bendix Prods. Div., South Bend 20, Ind.
Rockwell Spring & Axle Co., Newton Falls, Ohio
Roth Plating Corporation, South Bend, Ind.
Standard Plating Works, Inc., Goshen, Ind.
The Studebaker-Packard Corp., South Bend, Ind.

ST. LOUIS

Secretary-Treasurer: Ward W. Kelly
7046 Deerpath Drive, St. Louis 23, Mo.

Meeting Place: York Hotel, 2822 LaSalle St., St. Louis 4, Mo.

Day of Month: Second Wednesday
Time:

Sustaining Members:

American Zinc Sales Co., St. Louis, Mo.
Bussman Mfg. Co., St. Louis, Mo.
Chandeysson Electric Co., St. Louis, Mo.
Davies Supply & Mfg. Co., St. Louis 16, Mo.
Folding Carrier Corp., Oklahoma City, Okla.
C. Hager & Sons Hinge Mfg. Co., St. Louis 5, Mo.
Knapp-Monarch Co., St. Louis 16, Mo.
Lasalco, Inc., St. Louis 4, Mo.
Maurer Supply Co., St. Louis, Mo.
National Rejectors, Inc., St. Louis 15, Mo.
G. S. Robins Co., St. Louis 2, Mo.
Sommers Brothers Mfg. Co., St. Louis 7, Mo.

SAN ANTONIO

Secretary-Treasurer: Robert C. Cripe
2209 Texas Ave., San Antonio, Texas

Meeting Place: DeWinne's Belgium Inn, 3119 W. Commerce St., San Antonio, Texas

Day of Month: Third Monday
Time: Dinner 6:30 P.M.—Program 8:00 P.M.
Sustaining Members:
None

SAN FRANCISCO

Secretary: William A. Nairne
1495 Custer Ave., San Francisco, Calif.
Meeting Place: Patores Restaurant, 2550 El Camino Real, Redwood City, Calif.
Day of Month: Second Thursday
Time: 7:30 P.M.
Sustaining Members:
None

SEATTLE-PUGET SOUND

Secretary: William P. Foley
3674 4th Ave., South, Seattle 4, Wash.
Meeting Place: Varies—as announced
Day of Month: Third Tuesday
Time: 8:00 P.M.
Sustaining Members:
None

SOUTHEASTERN

Secretary-Treasurer: Robert H. Probert
1078 Washington St., S. W., Atlanta, Ga.
Meeting Place: Belmont Steak House, Downtown Luckie St., Atlanta, Ga.
Day of Month: Second Friday
Time: 7:30 P.M.
Sustaining Member:
Production Plating Company, Adel, Ga.

SOUTHERN TIER

Secretary-Treasurer: Roger Wheeler
Box No. 48, Killawog, N. Y.
Meeting Place: Ah-wa-ga Hotel, Owego, N. Y.
and
Iron Kettle Inn, Waverly, N. Y.
Day of Month: Third Tuesday
Time: 7:30 P.M.
Sustaining Member:
International Business Machine Corp., Endicott, N. Y.

SPRINGFIELD

Secretary: Henry L. Heissfeld
74 Chilson St., Springfield, Mass.
Meeting Place: Blake's Restaurant, 15 Mark St., Springfield, Mass.
Day of Month: Fourth Monday
Time: Dinner 7:00 P.M.—Technical Session 8:00 P.M.
Sustaining Members:
The Chemical Corporation, Springfield, Mass.
Moore Drop Forging Co., Springfield, Mass.

SYDNEY

Secretary-Treasurer: E. A. McAloon
65 Onslow St., Rosebay, N. S. W., Australia
Meeting Place: Trust Building, Martin Place & Castlereigh St.
Day of Month: Second Thursday
Time: 7:30 P.M.
Sustaining Members:
None

SYRACUSE

Secretary: Milton F. Stevenson
313 Beech St., North Syracuse 12, N. Y.
Meeting Place: Liederkrantz, 621 Butternut St., Syracuse, N. Y.
Day of Month: Third Monday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.
Sustaining Member:
Oneida, Ltd., Oneida, N. Y.

TOLEDO

Secretary: Ben Gomersall
6015 Anthony Wayne Trail, Route 1, Maumee, Ohio
Meeting Place: Angelo's Spaghetti House, Stickney Ave., Toledo, Ohio
Day of Month: First Thursday
Time: Dinner Meeting 6:30 P.M.
Business Meeting 8:00 P.M.
Sustaining Member:
The Electric Auto-Lite Co. (2), Sharonville 8, Ohio

TORONTO

Secretary-Treasurer: E. F. Hutt
85 Barford Rd., Rexdale, Ontario, Canada
Meeting Place: Royal York Hotel, Toronto, Ontario, Canada
Day of Month: Second Friday
Time: Dinner 6:30 P.M.—Meeting 8:30 P.M.
Sustaining Members:
Armalite Company, Ltd., Toronto, Ontario, Canada
Bomac Electrotype Co., Ltd., Toronto, Ontario, Canada
British Chrome & Chemicals (Canada) Ltd., Toronto 5, Ontario, Canada
Canada Cycle & Motor Co., Ltd., Weston, Ontario, Canada
Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario, Canada
Canadian Motor Lamp Co., Ltd., Windsor, Ontario, Canada
Houdaille Hershey of Canada, Ltd., Ontario, Canada
International Nickel Co. of Canada, Ltd., Toronto, Ontario, Canada
Lea Manufacturing Co. of Canada, Ltd., Toronto, Ontario, Canada
Metal & Thermit—United Chromium of Canada, Ltd., Toronto, Ontario Canada
W. W. Wells, Ltd., Scarborough, Ontario, Canada

TWIN CITY

Secretary-Treasurer: Robert L. Buckley
205 11th Ave., South, Minneapolis 15, Minn.
Meeting Place: Jax Cafe
Day of Month: First Monday
Time: 7:00 P.M.
Sustaining Members:
None

WATERBURY

Secretary-Treasurer: Albert G. Griffith
94 Ridgeview Place, Cheshire, Conn.
Meeting Place: Colonial Room, Roger Smith-Elton Hotel
Day of Month: Second Thursday
Time: Dinner 6:00 P.M.—Meeting 8:00 P.M.
Sustaining Members:
All Brite Chemical Co., Watertown, Conn.
American Brass Company, Waterbury 20, Conn.
American Electro Products, Inc., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury 91, Conn.
Eastern Electroplating Co., Terryville, Conn.
Harper Leader, Inc., Waterbury 20, Conn.
The International Silver Co., Meriden, Conn.
The Lea Mfg. Co., Waterbury 20, Conn.
W. D. MacDermid Chemical Co., Bristol, Conn.
MacDermid, Inc., Waterbury 20, Conn.
Mattatuck Mfg. Co., Waterbury, Conn.
Scovill Mfg. Co., Waterbury 20, Conn.
Seymour Mfg. Co., Seymour, Conn.
The Summit Finishing Co., Inc., Thomaston, Conn.
The Waterbury Plating Co., Waterbury 86, Conn.
Whyco Chromium Co., Inc., Thomaston, Conn.

WESTERN ONTARIO

Secretary-Treasurer: R. A. Campbell
268 Cecil St., Sarnia, Ontario, Canada
Meeting Place: William Pitt Hotel, Chatham, Ontario, Canada
Day of Month: Third Friday
Time: 6:30 P.M.—Dinner-Meeting
Sustaining Members:
Bendix Eclipse of Canada, Ltd., Windsor, Ontario, Canada
General Motors of Canada, Ltd., Oshawa, Ontario, Canada
Ontario Steel Products Co., Ltd., Chatham, Ontario, Canada

WICHITA

Secretary: Estel E. Starr
1685 Elpyco, Wichita 9, Kansas
Meeting Place: Oriental Restaurant, 5405 E. Central, Wichita, Kans.
Day of Month: Fourth Wednesday
Time: 6:00 P.M.
Sustaining Member:
Continental Can Company, Inc., Coffeyville, Kansas

Mayor Jean Drapeau

MESSAGE TO AES FROM HIS WORSHIP MAYOR JEAN DRAPEAU

I do not think that I need to tell you that Montreal welcomes you to our Canadian Metropolis, because I am sure that most of you have already heard that this city always has its arms wide open to delegates, visitors and tourists. Also, I consider it would be superfluous for me to say that, as Mayor of this great city, I personally welcome you and express my thanks to you for coming and my appreciation of the good judgment of your convention committee in choosing Montreal for this your 44th annual convention.

To those who are here for the first time, I can guarantee that they will not be disappointed and that they will not only realize all their visions of this great Crossroads of America but that their pleasure will exceed their fondest anticipations.

For the benefit of those who are not so well acquainted with us, I could add that Montreal enjoys the enviable position and reputation of being one of the most popular convention cities on the continent. It is the juncture of ocean and fresh water navigation, the terminal of the greatest railway systems in America, a centre of financial, commercial and industrial interests unequalled in Canada and is the seat of two of the greatest educational institutions in our country—McGill and Montreal Universities.

But perhaps the most attractive and inspiring of our characteristics, is the bi-ethnic quality of our city and its citizens who have blended the oldest and best of European cultures into a harmonious and unique whole. As you know, Montreal is the second largest French-speaking city in the world.

Yes, I repeat, you are welcome to our city and it is my wish that, not only will you have every success in your convention but that you will be so delighted that you will come again—and often.

Jean Drapeau
MAYOR OF MONTREAL

Mrs. G. R. Davidson

AES LADIES: WELCOME

A Warm Welcome Ladies. We have been planning for a long time to welcome you to Montreal, and we do so most cordially. It has been a real pleasure for us to plan the events of our Convention for the Ladies. We trust that you will find them enjoyable and entertaining. We are anxious that your visit with us be truly enjoyable in every way, and stand by to serve you.

Mrs. G. Ross Davidson
LADIES' CHAIRMAN

WELCOME AES MEMBERS

For the first time in over twenty five years, the Montreal Branch has the pleasure of playing host to the annual AES Convention, and it is our happy privilege to extend a sincere and cordial welcome to you, your family and friends. Our Educational Chairman and the Editorial Board have been endeavoring to develop a rounded Educational Program for you.

Two objectives have been paramount in their planning. First, to present a program encompassing the most current findings and investigations in our rapidly changing industry, and secondly, to maintain the fine quality of their context which has become a tradition throughout previous conventions.

The many social functions have been planned over the past two years, in an effort to provide a well-rounded program. It is the sincere hope of the entire Committee that you will participate in them, and find them enjoyable. We hope you will call freely on our Committee for anything which we may be able to do to make your visit to Montreal profitable and enjoyable.

G. R. Davidson

G. Ross Davidson
GENERAL CONVENTION CHAIRMAN

B. D. Ostrow

A. C. Tulumello

Dr. W. Beck

C. B. Sanborn

F. I. Nobel

Program of Events
44TH ANNUAL CONVENTION
Sheraton-Mount Royal Hotel, Montreal, Canada

JUNE 16—SUNDAY

9:30 A.M.—National Association of Metal Finishers (NAMF) Annual Meeting	SALONS C-D-E
10:00 A.M.—American Electroplaters' Society (AES) Executive Board Meeting	SALON I
10:45 A.M.—NAMF Board Meeting (Continued at 1:30 P.M.)	SALONS C-D-E
1:00 P.M.—Registration AES (to 9:00 P.M.)	BALLROOM
2:00 P.M.—MFSA Board of Trustees Meeting	ROOM POSTED
8:30 P.M.—AES Get-Together Party Admission by registration book ticket	CHAMPLAIN ROOM

JUNE 17—MONDAY

8:30 A.M.—Registration AES (to 9:00 P.M.)	BALLROOM to 6 P.M. 9TH FLOOR LOBBY to 9 P.M.
10:00 A.M.—Opening Session & Business Meeting Invocation—Rev. Frank C. Mesle Rochester Branch Address of Welcome—Superintendent E. Brakefield-Moore, Royal Canadian Mounted Police	CHAMPLAIN ROOM
11:00 A.M.—Business Meeting, Supreme Society, AES	CHAMPLAIN ROOM
12:00 Noon—MFSA Luncheon & Annual Business Meeting	NORMANDIE ROOM
12:00 Noon—Branch Secretaries' Luncheon	SALON B
12:00 Noon—Ladies' Luncheon & sight-seeing tour of Montreal Windsor Hall, Windsor Hotel—Admission by registration book ticket	
12:30 P.M.—Speakers' Luncheon	SALON A
1:30 P.M.—National Association Metal Finishers Educational Session	SHERATON HALL
2:30 P.M.—Editorial Board Meeting	SALON F
2:30 P.M.—First Educational Session	CHAMPLAIN ROOM

Session Chairman—Cleveland F. Nixon, General Motors Corps, Research Division

1. LEVELING IN CYANIDE COPPER BATHS—A FURTHER STUDY

by Barnet D. Ostrow and Fred I. Nobel, Lea Ronal, Inc.

This paper is a continuation of the study presented at the 41st Annual Convention. The disadvantages of PR cycles as a leveling medium are discussed, and it will be shown that with the standard cyanide copper baths used to date either zero or negative leveling only can be secured. It will be shown that positive leveling in a new type cyanide copper bath can be secured and that such leveling is equivalent to that obtained from leveling acid copper and nickel baths.

W. W. Sellers

J. M. Andrus

A. A. Johnson

L. O. Gilbert

Dr. E. J. Seyb

F. A. Lowenheim

S. L. Henn

H. J. McAleer

E. T. Candee

J. Zajdowski

2. BRIGHT AND SEMI-BRIGHT CRACK-FREE CHROMIUM

by Dr. E. J. Seyb, A. Albert Johnson and Angelo C. Tulumello, Metal & Thermit Corp.

Properties of the deposit in comparison with usual chromium deposits are illustrated. Applications in which this deposit gives exceptional results are discussed. These include improved corrosion resistance, the reduction of undercoat requirements, and improvement in wear resistance.

3. ELECTROPLATING ON NICKEL AND NICKEL ALLOYS

by W. W. Sellers, C. B. Sanborn, The International Nickel Co., Inc.

Methods are discussed for electroplating nickel on alloys such as 30 to 60 per cent nickel alloys, Invar, Durinickel, Ni-Resist, Nionel, etc. The mechanical preparation and cleaning procedures for nickel and these nickel alloys are discussed. Methods for treating them to effect satisfactory adhesion to the nickel coating are presented in tabular form.

4. CORROSION RESISTANCE OF TIN AND TIN ALLOY ELECTRODEPOSITS

By Frederick A. Lowenheim, Metal & Thermit Corp.

This paper summarizes the properties of electrodeposits of tin and some selected tin alloys with regard to their corrosion behavior. It combines a review of the literature with the presentation of new work.

6:00 P.M.—NAMF Cocktail Party & Dinner	SHERATON HALL
6:30 P.M.—Past Presidents' Dinner	SALON B
8:30 P.M.—Open House MFSA Hosts—Refreshments and Dancing—Buffet served at 10:30 P.M. Admission by registration book ticket	CHAMPLAIN & BALLROOM

JUNE 18—TUESDAY

8:00 A.M.—Speakers' Breakfast	SALON A
8:00 A.M.—Research Committee Breakfast	SALON D
9:00 A.M.—Registration AES (to 9:00 P.M.)	
9:00 A.M.—Public Relations Committee Meeting	SALON C
9:30 A.M.—Second Educational Session	BALLROOM

Session Chairman—Walter L. Pinner, Houdaille Industries

5. THE EFFECTS OF PLATING ON HIGH TENSILE STRENGTH STEEL

by Dr. Walter Beck and Edward J. Jankowsky, U. S. Naval Base, Philadelphia, Pa.

By means of a C ring specimen which the author describes, the author discusses the testing of stresses caused by plating on high tensile steels. He also discusses the extent of stress cracking obtained in various electroplating baths.

L. E. Lancy

M. H. Jones

S. R. Rich

C. F. Ivins Jr.

W. F. Stevens

6. THE INFLUENCE OF THE PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIS METAL ON ELECTROPLATING

IV. THE EFFECTS OF DIFFERENT FERROUS METALS ON THE PERFORMANCE OF A WATTS NICKEL DEPOSIT

by Dr. M. H. Jones, Chih-Yeu-Lu, J. Zajdowski

A detailed study is reported on the influence of twelve different ferrous metals on the durability of 0.0005 inch and 0.001 inch deposits of Watts nickel. A statistical analysis of the corrosion data has shown that there are significant differences in the performance of certain basic metals at both deposit thicknesses.

7. ANALYTICAL METHODS FOR TRACE QUANTITIES OF CYANIDE COMPOUNDS IN THE PLATING ROOM EFFLUENT

by W. Fred Stevens and L. E. Lancy, Lancy Laboratories

A simple and fast qualitative method for trace quantities of cyanide compounds is described. Quantitative estimation is possible through repeat tests with a varied size sample.

An extremely rapid spot test is introduced with a sensitivity of 1 ppm cyanide.

8. ACCELERATORS AND THEIR FUNCTION IN PHOSPHATIZING SOLUTIONS

by Lloyd O. Gilbert, Rock Island Arsenal

The actual complex nature of "accelerators" usually nitrate or nitrite ions and their reaction is discussed and a theory is offered concerning possible reactions involved. Other factors which serve to accelerate coating formation are discussed and illustrations are given.

9:30 A.M.—Third Educational Session — CHAMPLAIN ROOM

Session Chairman—A. West, Canadian Hanson & Van Winkle Company Ltd.

9. NEW LOOK IN PLATING ROOM POWER

by C. F. Ivins Jr., Hanson-Van Winkle-Munning Company

This paper presents to both the practical plater and the control scientist a complete analysis of plating room power. Motor generator sets, all types of rectifiers including germanium are discussed and explained pointing out the advantages and disadvantages of each as well as their limitations.

Types of controls for both rectifiers and generators are also discussed.

10. THE LATEST DEVELOPMENTS IN ELECTROPLATING WITH ULTRASONICS

by Stanley R. Rich, General Ultrasonics Corporation

The application of low-frequency, ultrasonics to electroplating is further elaborated. Results in chrome-nickel-copper plating are described and quantitative data presented. Demonstration will be made and typical ultrasonically plated parts will be exhibited.

11. CORROSION AND MATERIALS OF CONSTRUCTION IN THE PLATING ROOM

by T. J. V. Cudbird, Canadian Hanson & Van Winkle Co., Ltd.

This paper is divided into four sections, each section dealing with a particular phase as follows: the mechanism of metallic corrosion; the common metallics—applications and limitations; rubbers and vinyls; plating room floors.

12. THE FUTURE OF PLASTICS IN ELECTROPLATING PLANT

by Harold Silman, Electrochemical Engineering Co., Surrey, England

While plastics and non-metallic materials of construction have become increasingly important in the chemical engineering field, the electroplating industry has tended to be cautious in adopting them as extensively as it might, yet it is in the electroplating plant where they are most needed, since corrosion problems are accentuated by the presence of stray electric currents which are not easily controllable. This paper points out the various types of plastics available and illustrates many of their uses in the electroplating plant.

T. J. Cudbird

J. C. Withers

P. Glab

A. W. Logozzo

P. E. Ritt

H. Silman

11:00 A.M.—MFSA Golf Tournament

11:30 A.M.—Ladies' Luncheon, Vaudreuil Inn, sponsored by Oakite Products Inc., David X. Clarin as host

12:00 Noon—Branch Librarians' Luncheon — SALON L

12:30 P.M.—Speakers' Luncheon — SALON A

1:00 P.M.—Plant Visit No. 1—Canadian General Electric Co.
Plant Visit No. 2—Northern Electric Company Limited.
Make arrangements at Special Events Desk—Registration Area.

2:00 P.M.—Fourth Educational Session — CHAMPLAIN ROOM

Session Chairman—Dr. H. L. Kellner, Lea Mfg. Co.

13. A STUDY OF APPLICATION TECHNIQUE IN THE USE OF LIQUID BUFFING COMPOUNDS

by E. T. Candee and S. L. Henn, Lea Mfg. Co.

In this paper the results obtained by spraying liquid buffing compound onto a ventilated cloth buffing wheel, using varied controlled conditions are given. In a series of tests, wheel speed, distance of gun from wheel, atomizing pressure, amount of compound applied and rate of application are varied in an effort to determine improved efficiency and economy.

14. THE SISAL STORY

by Howard J. McAleer, Formax Mfg. Corp.

Woven sisal buffing wheels represent a relatively new buffing material that combines great strength and tough resiliency along with natural abrading and grease absorbing characteristics. Color slides illustrating the growth, harvesting and weaving of this imported hard vegetable fiber will be presented. The discussion covers the dual purpose polishing and buffing actions of sisal buffs, the various buffing wheel constructions that are available, the chemical treatments that can be applied to sisal buffs to enhance their performance and suggested uses and applications.

15. BARREL PLATING

by The Chicago Branch, AES, Presented by Paul Glab, Secretary

The advantages and disadvantages of oblique versus horizontal plating barrel will be discussed. Load size, method of loading and unloading, preparation of work, type of finish, rinsing and drying as well as post-plate treatments will be covered.

I. W. Wolf

R. F. Ledford

R. C. Spooner

A. E. Cahill

W. E. Pocock

16. INDUSTRIAL CHROMIUM PLATING—A FILM

by Arthur W. Logozzo, Nutmeg Chrome Corporation

2:00 P.M.—Research Committee Meeting — SALON J

7:30-
9:00 P.M.—Ladies' Plato Party, Mrs. Joan Wiarda, Hostess — SHERATON HALL

7:30-
9:00 P.M.—Technical Motion Picture — CARTIER ROOM

JUNE 19—WEDNESDAY

8:00 A.M.—Speakers' Breakfast — SALON A

8:00 A.M.—Fifth Educational Session — CHAMPLAIN ROOM

Session Chairman—Dr. Abner Brenner, National Bureau of Standards

17. FURTHER STUDIES OF NICKEL-IRON ELECTRODEPOSITS

by I. W. Wolf, General Electric Company

The effect of current density and plate thickness on the magnetic properties of a 79 per cent nickel-21 per cent iron alloy have been determined. In addition, the effectiveness of this material as a protective coating was tested. Some applications of this alloy are discussed.

18. IRIDIUM PLATING AND ITS HIGH TEMPERATURE OXIDATION RESISTANCE

by J. C. Withers and P. E. Ritt, Melpar, Inc.

A relatively easy method for plating iridium is discussed, giving the conditions which provide the best deposits. The paper will include methods for plating iridium on molybdenum and stainless steel alloys, thereby offering oxidation protection for these metals.

19. SURFACE REDUCTION OF COPPER

by Allen E. Cahill, General Electric Co., Syracuse, N. Y.

This paper deals with the deposition of copper from an alkaline cupric tartrate-formaldehyde solution on an electroless nickel deposit. Film thicknesses of up to 0.0015 inch have been achieved.

9:00 A.M.—Registration AES (to 9:00 P.M.) — 9TH FLOOR LOBBY

11:00 A.M.-
11:30 A.M.—Buses loading for Laurentian Outing & Buffet Lunch. Admission by registration book ticket

8:45 P.M.—Floor Show and Dance. Admission by ticket only — BALLROOM & CHAMPLAIN ROOM

JUNE 20—THURSDAY

8:00 A.M.—Speakers' Breakfast — SALON A

9:30 A.M.—Sixth Educational Session — CHAMPLAIN ROOM

Session Chairman—Dr. Ralph E. Schaefer, Clevite Graphite Bronze Company

20. THE SEALING OF ANODIC ALUMINUM OXIDE FILMS

by Roy C. Spooner, Aluminum Laboratories, Ltd.

Sulfuric acid anodic oxide films were prepared on an aluminum alloy using a wide range of sealing methods. These include water sealing at various pH values and sealing times, sealing in steam, in dichromate, nickel acetate, or silicone solutions. The effects of anodizing time and electrolyte temperature were also determined. A discussion of the sealed coating composition and the sealing mechanism is included.

21. A STUDY OF THE EFFECT OF VARIOUS FORMING ELECTROLYTES ON THE ANODIC FILM

by J. M. Andrus, Chroname, Inc.

An investigation of electrolytes not normally used for anodizing aluminum. The range of operation pertinent to current density, bath temperature and voltage is studied in relation to rate of dye absorption and hardness.

22. IMPURITIES IN CHEMICAL BRIGHT DIP SOLUTIONS FOR ALUMINUM—THEIR EFFECT AND REMOVAL

by R. F. Ledford, Industrial Filter and Pump Mfg. Co.

This paper deals with the effect and removal of the following contaminants from chemical bright dip solutions: calcium; magnesium; silicates; phosphates; carbonates; soils and soaps; polishing and buffing compounds.

23. THE ROLE OF CHROMATE TREATMENTS IN THE FINISHING OF ALUMINUM

by Walter E. Pocock, Allied Research Products

This paper will include a brief history of chromate treatments, their relation to other finishes and their scope at present.

Discussion on the formation, function and applications of chromate films on aluminum will follow.

9:30 A.M.—AES Business Meeting, Supreme Society (all day)	SHERATON HALL
11:30 A.M.—Ladies Luncheon, Helene de Champlain Restaurant, St. Helen's Island—sponsored by Udylite Corp'n., Dr. R. B. Saltonstall, Host	
1:00 P.M.—Plant Visit No. 3—Canadian Pratt and Whitney Aircraft Co., Ltd. Plant Visit No. 4—Canadair, Ltd. Make arrangements at Special Events Desk—Registration Area.	
7:00 P.M.—Annual Banquet and Dance Admission by reservation ticket—Your registration book ticket must be exchanged before 6:00 P.M. Tuesday, June 18, or Wednesday, June 19, for ticket bearing table reservations, at registration desk, 9th floor.	BALLROOM & CHAMPLAIN ROOM

JUNE 21—FRIDAY

8:00 A.M.—President's Breakfast for National Officers and Wives	SALON A
10:00 A.M.—Executive Board Meeting AES (all day)	SALON I

C. F. Nixon
Chairman
First Session

W. A. Pinner
Chairman
Second Session

A. West
Chairman
Third Session

H. L. Kellner
Chairman
Fourth Session

Abner Brenner
Chairman
Fifth Session

R. A. Schaefer
Chairman
Sixth Session

J. J. Duffy Jr.
President

M. M. Beckwith
1st Vice President

E. W. Couch
2nd Vice President

R. F. Ledford
3rd Vice President

T. A. Trumbour
Treasurer

A. P. Munning
Executive Secretary

METAL FINISHING SUPPLIERS' ASSOCIATION

SHERATON-MOUNT ROYAL HOTEL, MONTREAL, CANADA

JUNE 16—SUNDAY

2 P.M.—Board of Trustees Meeting — ROOM POSTED

JUNE 17—MONDAY

12 Noon—Luncheon and Annual Meeting — NORMANDIE ROOM

9 P.M. – 1 A.M.—Open House—Dancing and Buffet Supper — CHAMPLAIN ROOM & BALLROOM

JUNE 18—TUESDAY

11:00 A.M.—Golf Tournament—St. Hyacinth Golf Course (Hot Lunch Served)

H. J. Struckhoff
Past President

NATIONAL ASSOCIATION OF METAL FINISHERS

SHERATON-MOUNT ROYAL HOTEL, MONTREAL, CANADA

Harold W. Baker, Convention General Chairman

JUNE 16—SUNDAY

9:00 A.M.—Registration at NAMF Display Booth (to 9:00 P.M.) — NINTH FLOOR BALLROOM

9:30 A.M.—Annual Meeting of Membership — SALONS C-D-E

10:45 A.M.—Annual Meeting of Board of Directors — SALONS C-D-E

1:30 P.M.—Annual Meeting of Board of Directors (Continued) — SALONS C-D-E

JUNE 17—MONDAY

9:00 A.M.—Registration at NAMF DISPLAY BOOTH (to 5:30 P.M.) — NINTH FLOOR BALLROOM

9:30 A.M.—Public Relations—Membership Committee Meeting — EXECUTIVE SECRETARY'S SUITE

1:30 P.M.—ANNUAL EDUCATIONAL SESSION — SHERATON HALL

Roundtable: "Determining Costs in Certain Still, Barrel and Decorative Plating Work"

PANEL

Moderator: **A. T. Leonard,** Superior Plating Co., Minneapolis, Minn.

Glenn H. Friedt Jr.	Tony Stabile	Henry J. Siegel	J. Laurie Hay	Steve Palisin	Mariano Ranno
United Platers, Inc. Hamtramck, Mich.	Associated Plating Co., Inc. Los Angeles, Calif.	Siegel-Robert Plating Co. St. Louis, Mo.	Plating Service Co. Chicago, Ill.	Empire Plating Co. Cleveland, Ohio	Imperial Plating Co. Brooklyn, N. Y.

5:30 P.M.—Banquet Reservations — SHERATON HALL ENTRANCE

6:00 P.M.—Cocktail Hour — SHERATON HALL

7:00 P.M.—Annual Banquet — SHERATON HALL

Speaker: A. C. Wilkinson, Sales Promotion Mgr., Electrolux (Canada) Ltd.

John Palik Jr.
President

J. Robert Greenwell
1st Vice President

Webster B. Knight
2nd Vice President

Frank Kaiser
Secretary-Treasurer

Sal Novelli
Ass't. Secretary-Treasurer

P. Peter Kovatis
Executive Secretary

CONVENTION CHAIRMEN

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Educational

Mrs. G. R. Davidson
Ladies

G. R. Davidson
General Chairman

C. M. Douglas
Transportation and Outing

Dr. J. Kane
Educational Co-Chairman

J. T. Reisenburg Sr.
Publicity

S. A. Frost
Hotel

J. G. Carrique
Entertainment

B. T. Kelly
Banquet

M. Cohen
Plant Visitation

W. Feeley
Registration

B. Mendels
Finance

J. T. Reisenburg Jr.
Printing

W. Glover
Program

THE AMERICAN ELECTROPLATERS' SOCIETY
CONGRATULATES AND THANKS

WELL OVER three centuries ago, Paul de Chomedey, Sieur de Maisonneuve, created the first permanent settlement on a pleasant, green island on the banks of the St. Lawrence River—an island over whose forests of oak and elm and maple rose a Laurentian Mountain backdrop silhouetted against a Canadian sky. He named it Ville Marie de Montreal—today's Montreal.

Today's Montreal is a rich industrial city, rich also in traditions, basking in the reflected history of many yesterdays.

Every street is a pathway to history. Here, for instance, is the almost mythical village of Hochelaga. There is the place where, in 1644, Maisonneuve repelled the Iroquois thus rescuing the colonists from almost certain butchery. This place was inhabited by a renowned explorer—that by an illustrious general.

So, today's Montreal is linked with four centuries of North American exploration, discovery and development.

The American Electroplaters' Society (AES) discovered Montreal as an effective, satisfying, picturesque convention site some 27 years ago when the AES held a successful Annual Convention in that historic Canadian metropolis.

This June—27 years later—a larger, more mature AES is returning to that birthplace of a continent for its 44th Annual Convention.

During the period from June 16 through June 20, nearly 2000 AES members, their families and others related to the Society will live in one of three prominent Montreal hotels and partake abundantly of educational and relaxational fare to be provided by an enthused, experienced Host Branch and an industrious Convention Committee dynamically led.

The Convention Program spread on other pages of this Convention Issue tells its own full story of the range of the benefits available at this convention to AES members and their families.

In their behalf, the Society extends hearty thanks to those civic, hotel and other Canadian stalwarts who by their friendly interest and cooperation, have set the scene for a fruitful and enjoyable Montreal Convention stay.

It expresses genuine appreciation to the Montreal Branch itself, and particularly to the General Convention Chairman, his command staff and to all members of the Convention Committee for service in behalf of the AES and its members commensurate with the reputation of Montreal, historic island city, as Canada's renowned convention mecca.

AES NEWS

Newark Branch Wins Membership Expansion Competition

The Newark, St. Joseph Valley and the Mississippi Valley Branches prevailed in their respective divisions in the AES' Annual Branch Membership Expansion Competition for the twelve-month period ending March 31, 1957. Accordingly, an award of $50 will be presented at the 44th Annual Convention in Montreal to each of the winning Branches for achieving the greatest membership expansion during the year in their respective Divisions.

Meantime, the Society's aggregate membership, in all categories including Sustaining Memberships, mounted to a record 7521 on April 1, 1957 compared with 7101 members that same date the year before.

For the 1956–1957 fiscal year ending March 31, 1957, the five leaders in the AES' respective divisions were:

Branch	Members April 1, 1956	New Members	Net Change Membership	Per Cent Change
First Division (126 and More Members)				
1. Newark	271	62	+56.5	+20.8
2. Milwaukee	187	40	+35.5	+19.0
3. Toronto	164	28	+14.5	+ 8.8
4. Boston	130	11	+11.5	+ 8.8
5. Philadelphia	222	30	+13.0	+ 5.9
Second Division (70-125 Members)				
1. St. Joseph Valley	89	31	+28.0	+31.5
2. Dayton	98	27	+25.0	+24.5
3. New Haven	96	24	+23.5	+24.5
4. Montreal	89	21	+19.5	+21.9
5. Southeastern	70	17	+11.5	+16.4
Third Division (10-69 Members)				
1. Mississippi Valley	43	17	+16.0	+37.2
2. Hamilton	28	7	+ 5.0	+17.9
3. Houston	31	4	+ 4.5	+14.5
4. Western Ontario	33	5	+ 4.0	+12.1
5. Southern Tier	35	7	+ 4.4	+11.4

The speakers' table at the recent effective Los Angeles Branch Annual Technical Session at the Ambassador Hotel. Left to right, Dr. Samuel Heiman, AES president; Emmett H. Babcock, Branch librarian; Dr. Walter R. Meyer, president, Enthone, Inc. and Truman Stoner, Branch president.

Bob Wettstein

Western Advertising Representative of PLATING effective this issue is the noted firm of Bob Wettstein & Associates with Mr. Wettstein himself pictured above. With headquarters in Los Angeles and with offices also in San Francisco and Portland, Oregon, a staff including Walter Greenwood and Jerry Nowell, beside Mr. Wettstein, will cultivate PLATING advertising in ten Western states.

Virginia and North Carolina Platers Meet

The April meeting of the electroplaters of southern Virginia and northern North Carolina was held at Archie's Lobster House in Roanoke, Virginia. Twenty-one were present. Bruce E. Wallace, superintendent of finishing for the Bassick-Sack division of Stewart Warner Corporation, spoke on "Bright Nickel Plating". Limiting his remarks to the Watts type bath, Mr. Wallace discussed various problems arising in making up, operating and maintaining the bath. The behavior of brighteners and wetting agents, as affected by carbon purification and by use of inert anodes was pointed out. Then with Jim Kinnerly, who is in charge of the laboratory for the Bassick-Sack division, he showed various Hull cell panels to illustrate deviation of the composition of the nickel plating bath.

The speaker was introduced by H. R. Welfare of the Reynolds Co.

Plans were made for more informal meetings until the permanent interest of the group is established. Then a formal organization will be formed.

Rockford Branch Sets Dates

Rockford Branch has chosen September 12 as the date for Phae-Dae. Harold Ellis has been named chairman. The Branch's next annual educational session and banquet is planned for March 15, 1958.

USE CHROMIUM CHEMICALS BY MUTUAL

The gleam of superb chrome plating always raises an answering gleam in buyers' eyes. And in the plating shops which must achieve this mirror-bright finish, the chances are you'll find Mutual Chromic Acid. The reasons: Mutual Chromic Acid contains a CrO_3 content of 99.75% minimum, while sulfates do not exceed 0.1% SO_4.

Mutual, the world's largest producer of chromium chemicals, has an enviable record of prompt delivery, even in periods of tight supply. Finally, Mutual is happy to give technical service where needed. Ask your supply house about Mutual chromium chemicals, or write Mutual direct.

MUTUAL CHEMICAL DIVISION

MUTUAL — ALLIED CHEMICAL & DYE CORPORATION — Allied Chemical

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 638.

IN THE CAMERA'S EYE AT THE EMPIRE STATE REGIONAL

(Upper Left) Seated, left to right, George W. Cavanaugh, general chairman; V. P. McConnell, educational chairman; (standing) Art Martineau Jr., treasurer, Milt Stevenson, secretary and Ken Parnell, member—Board of Managers, all Syracuse Branch. (Top Right) Educational Session speakers: R. A. Stricklen, Allied Research Products, Inc.; Dr. Frederick A. Lowenheim, Metal & Thermit Corp.; Dr. Abner Brenner, National Bureau of Standards; Dr. Edward A. Parker, Technic, Inc.; (Bottom Left) The ballroom at banquet time (Bottom Right) The afternoon Educational Session.

Syracuse Host for Empire State Regional

Approximetely 350 representatives of branch organizations of the AES met on Saturday, April 27, at the Hotel Onondaga, Syracuse, N. Y., for the Third Annual Empire State Regional Educational Session and Banquet.

Highlighting the day's program was the seminar held during the afternoon featuring discussions on new developments in metal finishing and problems encountered in daily practices.

Representatives from industrial, manufacturing firms of the State and Canada, together with many job-plating firms in the Central New York area, heard talks by professional leaders. **Vincent P. McConnell** was education chairman and seminar director.

PAST PRESIDENTS' "POT" TO PRESENT PRESIDENT

At the auspicious Annual Meeting of the Baltimore-Washington Branch held in Baltimore, Saturday, April 6, Dr. Samuel Heiman, President of the AES, received the famous "Pot" of the Order of Past Presidents. Presented annually to the incumbent National President by the Baltimore-Washington Branch, Dr. Heiman is the tenth to receive the annual award. Above, holding the silver-plated and gold-lined vessel, is Dr. Heiman with, left to right, Edward Oberland (Branch Librarian); Carl Thiede (Branch Secretary-Treasurer); Jules Horelick (Branch President) and Edward Bertucio (Branch Vice President).

Hydrogen embrittlement and its cures featured a talk during the seminar by **Dr. Abner Brenner,** chief of Electrodeposition Section, National Bureau of Standards, Washington, D. C. Other speakers were: **Dr. Edward A. Parker,** Providence, R. I.; **Dr. F. A. Lowenheim,** Rahway, N. J.; and **R. A. Stricklen** of Baltimore, Md.

Following the afternoon meeting, the delegates and their wives were guests at a dinner and entertainment. George W. Cavanaugh, general chairman, was toastmaster, and introduced Lindley S. Wood, president of the Syracuse Branch, host for the meeting.

Delegates attending represented branches from Albany (Capitol District), Rochester, Buffalo, the Tri-City area, and Montreal, Toronto and Hamilton, Canada.

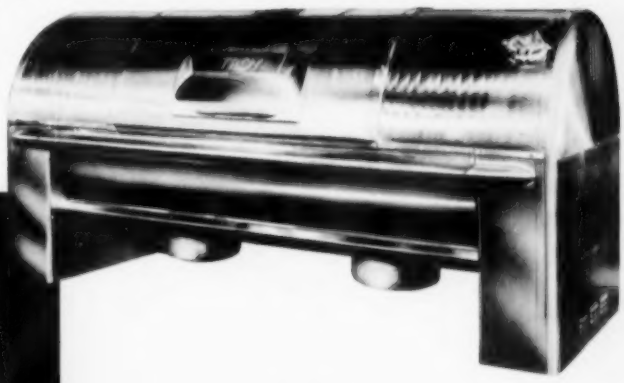
A special luncheon at 1 p.m. was arranged for the ladies who accompanied their husbands for the all-day session.

Committee chairmen included, Mr. Cavanaugh, publicity & general; Mr. McConnell, educational; Milton Stevenson, program; Mr. Wood, finance; Kenneth Parnell, tickets; Robert Colvin, hospitality; and Mrs. William Philips and Mrs. Herbert Gerhardt, ladies program.

INDICATE B 606. ➤

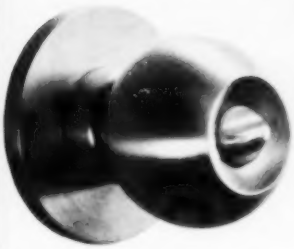
This is tomorrow's finish

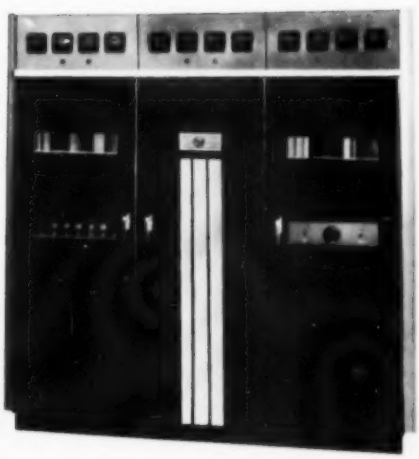
TODAY!



LEA

SATIN FINISH





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Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Brierley, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

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...holds the BLUE RIBBON against all comers

. . . one reason is that in addition to its original excellence it is ably supported by Addition Agents of Blue Ribbon Quality

Consistently turning out copper plate which has become the quality standard of the industry at a surprisingly low cost, Lea-Ronal High Speed Bright Copper, with Lea Copper Glo as the key additives, should be investigated by every plant operating with cyanide copper. It offers so much in values that it should be tried. The vast majority of those who try it, adopt it.

Complementing this fine copper plating formula are several excellent addition agents; all helping to give top-notch performance:

ULTRATARTRAL

no burning; permits much higher current densities than with conventional coppers; higher free cyanide; sodium cyanide can be used at higher current densities; better anode corrosion; greater carbonate tolerance.

SUPERTARTRAL

primarily for barrel plating, far superior to Rochelle Salts or other tartrates.

WETTING AGENT CW-7

highly soluble additive which prevents deposition of metals on anode during idle time thus preventing Monday morning blues; increases bath tolerance to organics.

Note: LEA-RONAL High Speed Bright Copper is another of the patented LEA-RONAL processes.

WETTING AGENT CW-6

low-foaming additive increases bath tolerance to organics in barrel plating.

T. S. T. PURIFIER

the best additive you can find for purifying baths containing chrome and other metal contaminants; particularly useful where zinc-chromium combinations exist.

CUPRALL

a well-proved process for providing all the values of Lea-Ronal Bright Copper with the exception of extreme brightness.

If you are interested in superior copper plate and high economy, you should make a thorough test of the Lea-Ronal High Speed Bright Copper Process. Set aside one tank and order enough for that tank. Give us your production schedule and we'll be glad to recommend the necessary quantity to make this comparative test.

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LEA GROUP
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Lea-Ronal, Inc., Jamaica, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Ltd.
Lea Mfg. Co., of England, Ltd.
Plating Polishing Buffing Burring

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Sales and Manufacturing Plant: 237 East Aurora Street, Waterbury 20, Conn.
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L·R

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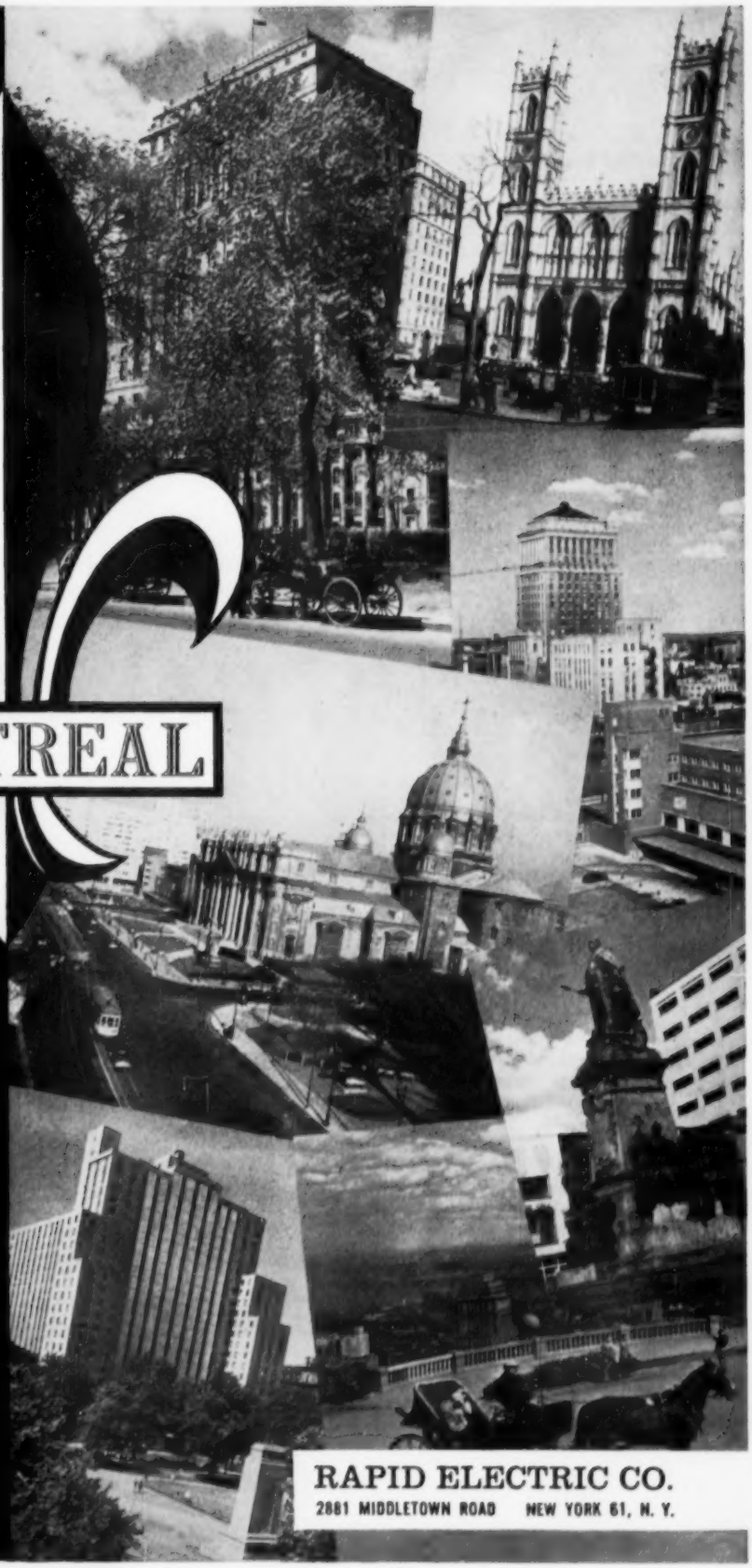

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VISIT OUR
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A.E.S.
CONVENTION

HOTEL SHERATON
MOUNT ROYAL

JUNE 16 to 20

Your Hosts:
Mr. James A. Viola
Mr. George Schore

RAPID ELECTRIC CO.
2881 MIDDLETOWN ROAD NEW YORK 61, N. Y.

Before the Supreme Society

The Supreme Society's large volume of business to be transacted at its Annual Meeting in Montreal, Thursday, June 20 will include consideration of the following proposals among others:

1. A Constitutional Amendment sponsored by the Executive Board increasing per capita tax due from each Branch from $5.70 to $7.70 per Active Member.
2. A Constitutional Amendment changing the Society's fiscal year from April 1–March 31 either to July 1–June 30 or May 1–April 30.
3. A Bylaw amendment deleting the membership promotion responsibility from the portfolio of the Second Vice President and instead vesting it in a nine-man Membership Committee, a standing committee with its personnel serving respective three year terms on a staggered basis.
4. A Bylaw amendment relieving the First Vice President of the responsibility of the educational program and instead vesting it in a nine-man Educational Committee, a standing committee with its members each serving a three-year term on a staggered basis.
5. A proposal championed by the Editorial Board reconstructing the entire Paper Awards System and providing nine such awards annually instead of six as at present.
6. A proposal perfected by a special presidential committee for a special AES Award for outstanding technical achievement. If adopted as proposed, the winner, to be chosen by a special Scientific Achievement Award Committee, will deliver a lecture at the Annual Convention and receive both a sizable cash award and a suitably inscribed scroll.

Manual Available to Branches

The AES's consolidated mimeographed looseleaf book Branch Officer's Manual has been completed and copies have issued from National Headquarters to all Branches that ordered them at $5.50 per copy.

Within red covers bound by Chicago screws, the Manual contains information on respective phases of Branch operation vital to the successful workings of every AES Branch. It includes five final supplements.

A limited extra quantity of the book is still available at National Headquarters for the accommodation of Branches that have not previously ordered copies. These will be sold to Branches (only), on a first-come, first-served basis so long as that supply lasts, at $5.50 per copy, including postage to one destination.

Write American Electroplaters' Society, Inc., American Building, 445 Broad Street, Newark 2, N. J. Payment should accompany order to obviate unnecessary bookkeeping expense.

Equipment and Supplies for Plating and Polishing

• • •

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UNICHROME
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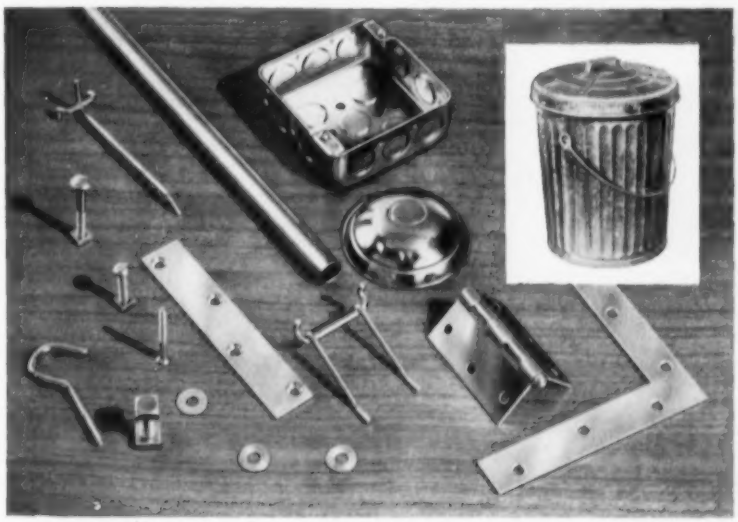
News about
COATINGS for METALS
Metallic.....Organic.....Decorative.....Protective

Chrome-like finishes produced at new low cost

New economical Unichrome Dip Compounds add sales appeal to zinc products



Typical products for which new economical Unichrome Dips are especially suited. Costs for dip compound are between 30¢ and 60¢ per 1000 sq. ft. of surface treated.

For the first time bright chrome-like finishes become economically practical for electrical conduit, junction boxes, toy wheel goods, and other low cost zinc plated products including rough hardware. Economical chromate treating with newly developed Unichrome Dips is now being used to increase shelf life and sales appeal of even the most competitively priced products.

The new Unichrome Clear Dips operate at extreme dilutions. Make-up costs are low. So are operating costs, even where dragout is a factor. A unique feature of these Dips is their stability, which saves through long "mileage" and consistent results.

Use of these Unichrome Dips also cuts need for brighteners in the zinc bath, since products emerge from the chromating solution with chrome-like brilliance. In fact, one plater saved 28 tons of *stained* zinc plated hardware by "wash coating" with Unichrome Dip and restoring brightness.

IMPORTANT FACTS ABOUT CHROMATE FINISHES

Since the chromate solution has a stripping action on the zinc, operating cycle affects results. So does the type of equipment. In order to get the color, corrosion resistance, uniformity and economy desired, the chromate process *must* be matched to the differing needs of automatic and manual finishing.

No single chromate material satisfies all needs. Metal & Thermit, long associated with the plating industry and problems of finishing with zinc, is well qualified to assure the proper dip for specific requirements. Unichrome Dip Compounds represent one of the widest lines of chromating materials available.

Time saved both in and out of chromium tank

Self-regulation is a must for the ultimate in fast chromium plating. Without it, there's still need for lengthy chemical analyses on solutions, and there's no assurance that baths are *always* in optimum plating balance.

Unichrome SRHS® Chromium is unique in that a reserve of chemicals is in the tank dissolving in just the amount to replenish losses. It thereby keeps the bath ingredients in optimum plating balance for best results. This not only saves time outside the tank on control tests, but also maintains high cathode efficiency and bright plate range. These in turn maintain high plating speed, enable a larger load to be covered per cycle, and minimize rejects and the waste of time and money they represent.

NEW CYLINDRICAL ANODE EXPOSES LARGER EFFECTIVE SURFACE

A new style of Unichrome round anode for chromium plating features a ribbed perimeter. The ribs give 75 current throwing edges or "points" in the 2" diameter anode, and 55 edges in the 1½" anode.

This multipoint ribbed anode prevents trivalent chromium build-up in solutions where cathode area is large. It also offers the advantages of the original smooth round Unichrome Anode. These include longer life, better current distribution, high conductivity, resistance to warping. Send for data sheet RRA-1.

Unichrome is a trademark of Metal & Thermit Corp.

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TRI-STATE REGIONAL AT FRENCH LICK, INDIANA
(Left) Furs on display at the Ladies Fashion Show. (Right) Head table at the Banquet.

INDIANAPOLIS HOST BRANCH TO FOURTH TRI-STATE

Indianapolis was host Branch to the Ohio, Kentucky and Indiana Fourth Annual Tri-State Regional Meeting at the French Lick-Sheraton Hotel in the famous spa of French Lick, Indiana on March 30. There were 400 in attendance at the meeting. Representatives were present from the AES Branches at Cincinnati, Columbus and Dayton, Ohio; Louisville, Kentucky; and Indianapolis, Indiana.

Frederick Anderson and M. Les Reynolds were chairman and co-chairman, respectively. Loren Stevens was the Educational Sessions Chairman.

National Third Vice President Ralph D. Wysong made the opening address at the Educational Session and acted as moderator.

Three papers were presented. R. O. Hull of the R. O. Hull Co., Inc. spoke on "The Practical Application of the Hull Cell to the More Common Plating Solutions."

Dr. T. J. Bulat chose as his subject the "Role of Ultrasonics in Electroplating." Dr. Bulat is head of the Ultrasonic Application Laboratory of the Pioneer-Central Div., Bendix Aviation Corp.

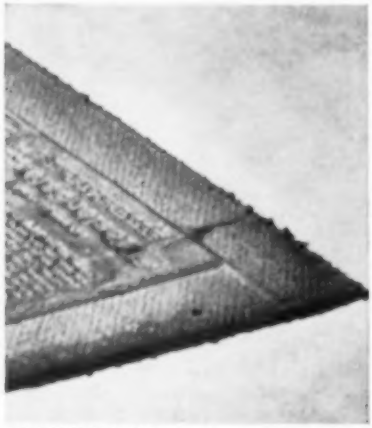
"Introduction to Nickel Conservation," was the title of the paper delivered by Cleveland Nixon, head of the Electrochemical Department of General Motors Corp.

At the business session of the Branch representatives, it was voted to suspend the bylaws and not have a regional meeting in 1958. This was done because Cincinnati Branch will be host to the 1958 AES 45th Annual Convention and all of the branches in the region will cooperate with Cincinnati in putting on the convention.

The ladies were entertained after the luncheon with a Style Show and, of course, joined the men at the evening banquet. The banquet grand door prize was a high fidelity record player. Entertainment and dancing followed the dinner.

Better work, less waste with "Plus-4" Anodes

TYPICAL TREEING that occurs when using ordinary electrolytic tough pitch copper anodes.



MINIMUM TREEING illustrates one of many savings with "Plus-4" (Phosphorized Copper) Anodes.

The Cincinnati Electrotype Co., of Cincinnati, Ohio, switched to Anaconda "Plus-4" Anodes and now tells its customers on its advertising blotters:

"We use PHOSPHORIZED COPPER because it has . . .

1. Finer, smoother *Grain Structure*. Retains the true value of modern type faces, dot formations of halftone, and tone value of multicolor engravings.
2. Over-all *Uniformity* of shell thickness, longer plate life, reduces replacement costs.
3. Greater *Tensile Strength*, maximum resistance to abrasive and chemical action of colored inks.
4. Sturdy *Backup* for Nickeltypes.
5. Better *Adhesion* for chrome."

From an operating standpoint, Cincinnati Electrotype is also enthusiastic. "Plus-4" Anodes cut waste from treeing (shown above), from solution correction and from sludge. With electrolytic tough pitch copper anodes, they used to clean sludge from tanks 3 times a year. Tanks filled exclusively with "Plus-4" Anodes will run a year or more without cleaning. They also report a time saving of 30% or more in a normal plating cycle when using "Plus-4" Anodes.

It will pay you to see for yourself how Anaconda "Plus-4" (Phosphorized Copper) Anodes can save you time and money—give you better work. Send the coupon today.

67141

"PLUS-4" ANODES
(Phosphorized Copper)
A product of
ANACONDA
Made by The American Brass Company

The American Brass Co., Waterbury 20, Conn.
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.
Give me details on how I can get a test quantity of "Plus-4" Anodes sufficient to supply one tank.

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COMPANY.....
ADDRESS.....
CITY.....ZONE....STATE.....

Investigation of the Nature of the Forces of Adhesion by L. R. Brantley and J. Charnell, Occidental College for Office of Naval Research. 89 pages. $2.25. Order PB 121555 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25.

Many methods have been devised for the measurement of adhesion by coating-substrate separation. Effective among these is the Interchemical Adherometer, a chisel-type instrument which measures the force necessary for a knife to scrape off a coating of a certain width from a substrate. This investigation reviews refinements in technique and interpretation of this type of measurement, and examines the relation to Adherometer adhesion, or "hesion," of other properties of a lacquer coating on a non-ferrous substrate. Evaluation of bulk shear through the friction properties of the coating received particular attention.

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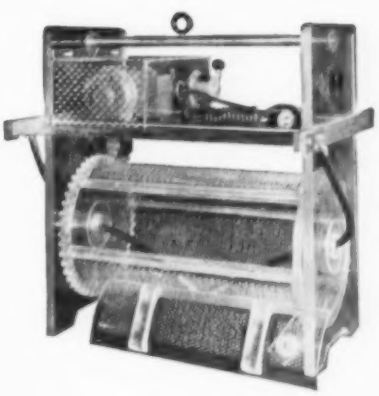

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1—6000/3000 AMPERE, 6/12 VOLT, Electric Products, Synch.

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1—**GREEN SELECTOPLATER**, 1800 AMPERE, 12 VOLT, 220/3/60.

1—SEL-REX SELENIUM, 1200 AMPS, 9V, for 440/3/60.

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4—1440/720 AMPERE, 6/12 VOLT, UDYLITE-MALLORY

1—750 AMPERE, 12 VOLT, SELF-CONTAINED SELENIUM, UDYLITE-MALLORY.

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2—CROWN & H-VW-M Centrifugal Driers No. 1 and No. 2 with Heat.

1—H-VW-M Full-Automatic Plating Machine, 87' long, 39" lift, was used for chrome.

2—**RONCI** Enamelers, No. R-100 and No. R-200.

1—**ALMCO** DB8 Deburring Barrel, 2 Comp. Vari Drive.

1—ALMCO DB-2 Deburring Bbl, lined.

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INTERSOCIETY NEWS

Molybdenum Plating Paper at Electrochemical Symposium

At the Washington, D. C., meeting of The Electrochemical Society, May 12-16, 1957, Paul L. Raymond, project manager in the Research Division of National Research Corporation, presented on Monday afternoon of that week a paper on "Molybdenum Plating Inside of Large Bore Tubes."

In brief, his paper stated that the high temperature reduction of molybdenum pentachloride by hydrogen was used to deposit high purity molybdenum plates inside of large bore tubes. A large number of plating runs were conducted to develop the equipment and procedures and to determine the optimum operating condition. Strong adherent plates of molybdenum 0.004 in. thick were deposited inside of tubes utilizing equipment constructed from common engineering materials and components.

Mr. Raymond, who holds his bachelor's degree in chemical engineering from Rensselaer Polytechnic Institute, has been associated with National Research Corporation since 1953. During this period he has devoted his efforts to the development of plating processes by reduction of metallic halides and to various programs for the reduction of titanium, zirconium and rare metals.

Corrosion Council Hears Reports of Research

The regular semiannual meeting of the Corrosion Research Council of the Engineering Foundation was held in the conference room of the Division of Metallurgy, National Bureau of Standards, Washington, D. C., on Tuesday, April 2, 1957. F. L. LaQue, chairman of the council presided.

Dr. A. T. Gwathmey chairman, Advisory Committee, and Dr. Jerome Kruger, in charge of the research, reported on recent progress and on plans for 1957 for the first Council-sponsored project, "Fundamental Corrosion Reactions at the Surface of Metals in Selected Environments." It has previously been shown by Dr. Kruger that the oxide films that form on single crystals of copper are distinct nuclei. The fact that they are not continuous is probably due to dislocations or other crystal imperfections. A technique of measuring the thickness of the films electrolytically has been developed and is being used; it is now planned to use an optical technique to study the films while they are being formed, which will make it possible to determine the rate of film formation on a perfect crystal and on an imperfect crystal. This may give a clue to the important question, "Why are oxide films not continuous?"

H. L. Logan, who is carrying on the stress-corrosion work at NBS, outlined the plan of the second research project to be done for the Corrosion Research Council in 1957. A study will be made of the orientation of the crystals in a magnesium alloy adjacent to a stress-corrosion crack, which is transcrystalline. This work will then be extended to the effect of hydrogen. A similar study will be made of crystal orientation at the fractures of a low-carbon and a low-alloy steel.

Marburg Lecture on Industrial Water

Everett P. Partridge, director, Hall Laboratories, Inc., Pittsburgh, will present the annual Edgar Marburg Lecture at the 60th Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J., on Wednesday afternoon, June 19.

This annual lecture is a memorial to the first secretary of the society, and was established to emphasize the importance of furthering the knowledge of properties and testing of engineering materials.

Dr. Partridge's lecture on industrial water is entitled "Your Most Important Raw Material." Water is as basic to industry as it is to life itself.

Dr. Partridge serves on many technical committees. He is a past chairman and currently is finance chairman of the Joint Research Committee on Boiler Feedwater Studies. He is a member of the Research Executive Committee of the ASME, the subcommittee on Care of Power Boilers of the ASME Boiler Code Committee, ASTM Committee D-19 on Industrial Water, NACE Committee T-3F on High Purity Water and the Intersociety Corrosion Committee.

In 1955, Dr. Partridge received the Max Hecht Award of ASTM Committee D-19 for outstanding service in the study of water as an engineering material.

Interested visitors will be welcome to attend this lecture whether or not they are members of the society.

Welch Elected President of SAMA

Richard E. Welch was elected president of the Scientific Apparatus Makers Association at the apparatus makers' 39th annual meeting held recently at The Greenbrier, White Sulphur Springs, West Virginia.

Mr. Welch is vice president and treasurer, W. M. Welch Manufacturing Co., Chicago. He succeeds Henry F. Dever, president, Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Philadelphia, who held the office for the past two years.

Dr. G. A. Downsbrough, president, Boonton Radio Corp., Boonton, N. J., was elected SAMA president pro tempore.

ABOVE: An operator removing a speaker bracket from the bath of "Coppralyte."

RIGHT: Speaker brackets before and after plating.

ELECTRO-VOICE FINDS DU PONT COPPRALYTE®:

"Dependable... efficient... a well-balanced plating solution..."

"We installed a copper-plating process using Du Pont Coppralyte in our electro-plating department eight years ago,"* reports Mr. Howard Taylor, Finishing Department Superintendent for Electro-Voice, Inc., Buchanan, Michigan. *"We've found 'Coppralyte' to be dependable . . . efficient . . . well-balanced and easy to maintain. I'd recommend this bath anywhere!"*

Electro-Voice is a recognized leader in the audio equipment field. In the eight years that Du Pont "Coppralyte" has been used, over 4,000,000 microphone and speaker components have been processed in their plating operation at the rate of about 2,000 units daily. Parts are plated for 20 minutes in the "Coppralyte" bath at 25 amps. per square foot.

Let Du Pont's technical service organization and experience aid you in selecting chemicals and processes to meet *your* requirements. Contact your Du Pont representative or write: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

*"**COPPRALYTE**" *is Du Pont's registered trademark for copper-plating salts and chemicals.*

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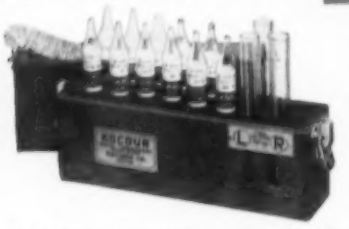
INCREASE YOUR PRODUCTION WITH KOCOUR PLATING TEST EQUIPMENT

All successful platers know that using KOCOUR plating test equipment means better plating, more production, lower costs, increased profits.

● The KOCOUR Sulfate Test Set enables anyone to accurately and quickly determine the sulfate content of a chromium plating bath in order to maintain a constant check on the ratio of sulfates to chromic acid. . . . This is important to insure consistently good plating results. . . . The entire test takes about 7 minutes . . . no calculations are necessary.

● The KOCOUR Chromic Acid Test Set was designed to accurately and simply determine the chromic acid content of chromium solutions. While a hydrometer is sometimes used for this determination, if close control is desired, the solution should be analyzed.

The set is self-contained . . . reads directly . . . is accurate to the one-half ounce per gallon of chromic acid . . . one simple subtraction is the only necessary calculation.



● Many platers use the KOCOUR Set "CR" for determining trivalent chromium in chromium solutions. The importance of this set is that a chromium solution high or low in trivalent chromium is not only expensive to operate but also is the cause of much spoiled work. The set is simple to operate . . . cost of upkeep small . . . no calculations are necessary.

● KOCOUR are specialists and pioneers in testing equipment for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.

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PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,769,774, November 6, 1956—Electrodeposition Method—T. Loveland and A. Prust, assignors to Republic Steel Corp., Cleveland, Ohio.

To cover a metal article with a corrosion resistant coating, make the article the cathode in an aqueous solution of 10 per cent to 35 per cent chromic acid and 3 per cent to 12 per cent phosphoric acid at 75 to 500 asf using a lead or lead tin anode.

12 claims.

No. 2,769,775, November 6, 1956—Electrolyte for Copper Refining—J. Schloen and E. Elkin and K. Ekler, assignors to Canadian Copper Refinery, Ltd., Montreal, Canada.

This copper refining bath of $CuSO_4$ and H_2SO_4 contains 0.0012 to 0.0036 g/l of glue and 0.0008 to 0.0072 g/l polyvinyl alcohol.

8 claims.

No. 2,769,778, November 6, 1956—Method of Making Transparent Conducting Films—J. Preston, assignor to National Research Development Corp., London, England.

Tin or indium are sputtered on the material in the presence of oxygen insufficient to oxidize the metal completely as a thin yellow-to-brown coating. Then the coated surface is heated under oxidizing conditions until it becomes substantially transparent.

7 claims.

No. 2,770,586, November 13, 1956—Grid Bearing—E. Davis, assignor to General Motors Corp., Detroit, Mich.

Silver is deposited on a backing member on which a multiplicity of indentions is die formed. The indentions are filled with soft bearing material, part of which is removed and tin plated over the resulting surface. See also No. 2,771,409 issued to General Motors on 11/20/56.

9 claims, figure.

No. 2,770,587, November 13, 1956—Bath for Plating Bright Copper—B. Ostrow, assignor to Elechem Corp., Jersey City, N. J.

The use of selenium in the −2 valence state in copper plating baths in amount to exert a brightening affect on the copper deposit is described. Specific compounds mentioned include alkali metal selenocyanates, selenides and a number of organic selenium compounds.

14 claims.

No. 2,771,415, November 20, 1956—Electrolytic Apparatus—A. Ross, assignor to the National Electroform Mold Co., Baltimore, Md.

An apparatus for electroforming mold cavities, force plugs, molds and dies, is described, including an anode basket for holding scrap metal as source of metal to be plated.

4 claims, 4 figures.

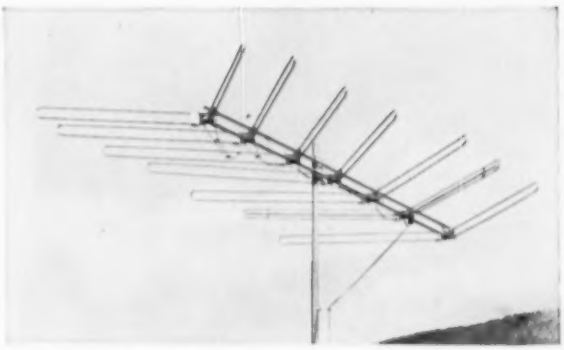
$2,000 a Month Saved By Channel Master!

By Using Ion Exchange To Purify Chromic Acid Bright Dip

Channel Master Corp., of Ellenville, N. Y., is the world's largest manufacturer of television antennas and accessories. One important reason for this leading position in a new and highly competitive field is the extremely high quality they have set for all their products.

One of these standards requires that the antenna withstand the corrosive effects of weather during its years of service. Although the antennas are primarily made of aluminum, steel clamps used in assembly can be affected by weather. In order to protect these steel parts and other vital accessories, such as mounting brackets and insulating hardware, from corrosion, they are first zinc plated and then dipped in a chromic acid type bath and sent through rinsing and bleaching baths to give them a bright finish. The bright dip bath loses its bite rapidly — affecting quality and requiring either discharge or treatment.

Channel Master's modern plant located in the heart of New York's resort area.



Channel Master TW fringe area antenna.

Channel Master thoroughly investigated all known methods of treatment to find the one most suitable for their needs. They finally chose a Graver Ion Exchange system tailored to fit into the overall plating operation. This system restores the original bath quality and eliminates bath dumping. The equipment has now been in operation for over two years.

Results

- $2,000 a month saved by Channel Master using Graver Ion Exchange
- Difficult waste disposal problem solved
- Better rinsing from demineralized water

Write for Technical Reprint T-143 describing the operation of above system and Bulletin WC-111 describing Graver Ion Exchange Systems.

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Industrial Waste Dept W-511

GRAVER WATER CONDITIONING CO.

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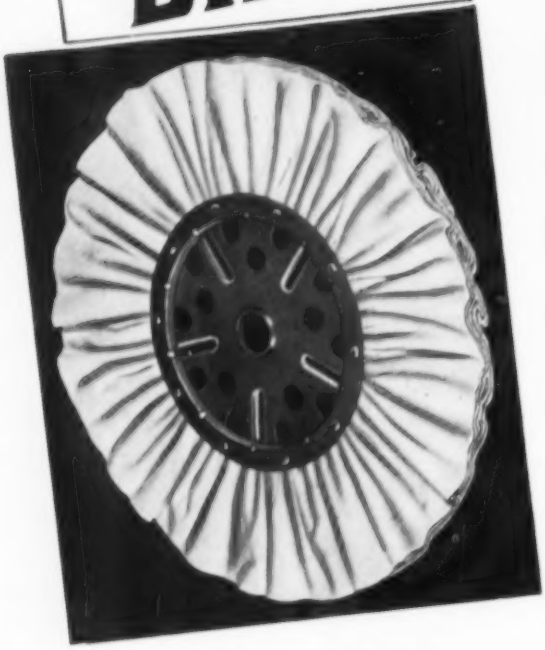
Riegel BIAS



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The BIAS BUFF *and* WHEEL CO.

Division of RIEGEL Textile Corporation

3464-66 Hudson Boulevard Jersey City 7, N. J.

PATENT ABSTRACTS

No. 2,772,183, November 27, 1956—Chemical Nickel Plating Process—P. Talmey, et. al., assignors to General American Transportation Corp., Chicago, Ill.

A more adherent nickel deposit is obtained on steel if the object is dipped into a 1 per cent by weight hydrogen peroxide solution, then into an aqueous solution, *p*H of 1.9 to 3.5, of a nickel salt to obtain a displacement coating of nickel, after which the object is plated in an electroless nickel solution.

21 claims.

No. 2,773,816, Dec. 11, 1956—Method for Electrorefining Metal—A. Wesley and R. McKay, assignors to International Nickel Co., N. Y.

Claim 1 reads: "As a new article of manufacture, a composite dividable electrolytic nickel plate comprising an imperforate nickel starting sheet having a plurality of continuous lines of resist applied at corresponding locations on opposite faces thereof and extending across said faces, and an electrolytic nickel deposit upon said faces covering said lines of resist and having a thickness of nickel deposit upon each face that is related to the width of a line of resist on the face as determined by the following formula:

$$W = \frac{2T}{3} + \frac{T}{10}$$

wherein W is the width of the line of resist and T is the thickness of the nickel electrodeposit on the face to which said line of resist has been applied, said plate being readily dividable into pieces of smaller area having substantially smooth and straight edges by bending along lines corresponding to the locations of said lines of resist.

7 claims, 8 figures.

No. 2,773,817, December 11, 1956—Composite Metal—James Russell, et. al., assignor to Ekco Products Co., Chicago, Ill.

An article with a tin outer layer is anodized to form tin oxide which in turn is coated with a stable high temperature film after which the organic film is cured at 150 to 400 C and the green oxide of tin formed.

11 claims.

No. 2,773,818, December 11, 1956—Alkaline Nickel Plating Solution—A. DuRose, et. al., assignors to The Harshaw Chemical Co., Cleveland, Ohio.

Nickel may be deposited from a solution containing nickel chloride, nickel sulfate, and mixtures thereof equivalent to 75 to 250 g/l of nickel sulfate ($6H_2O$), a complexing agent (polyalkanolamine) in the amount of 25 to 175 g/l, and a polyalkanol amine stabilizer from 25 to 200 g/l.

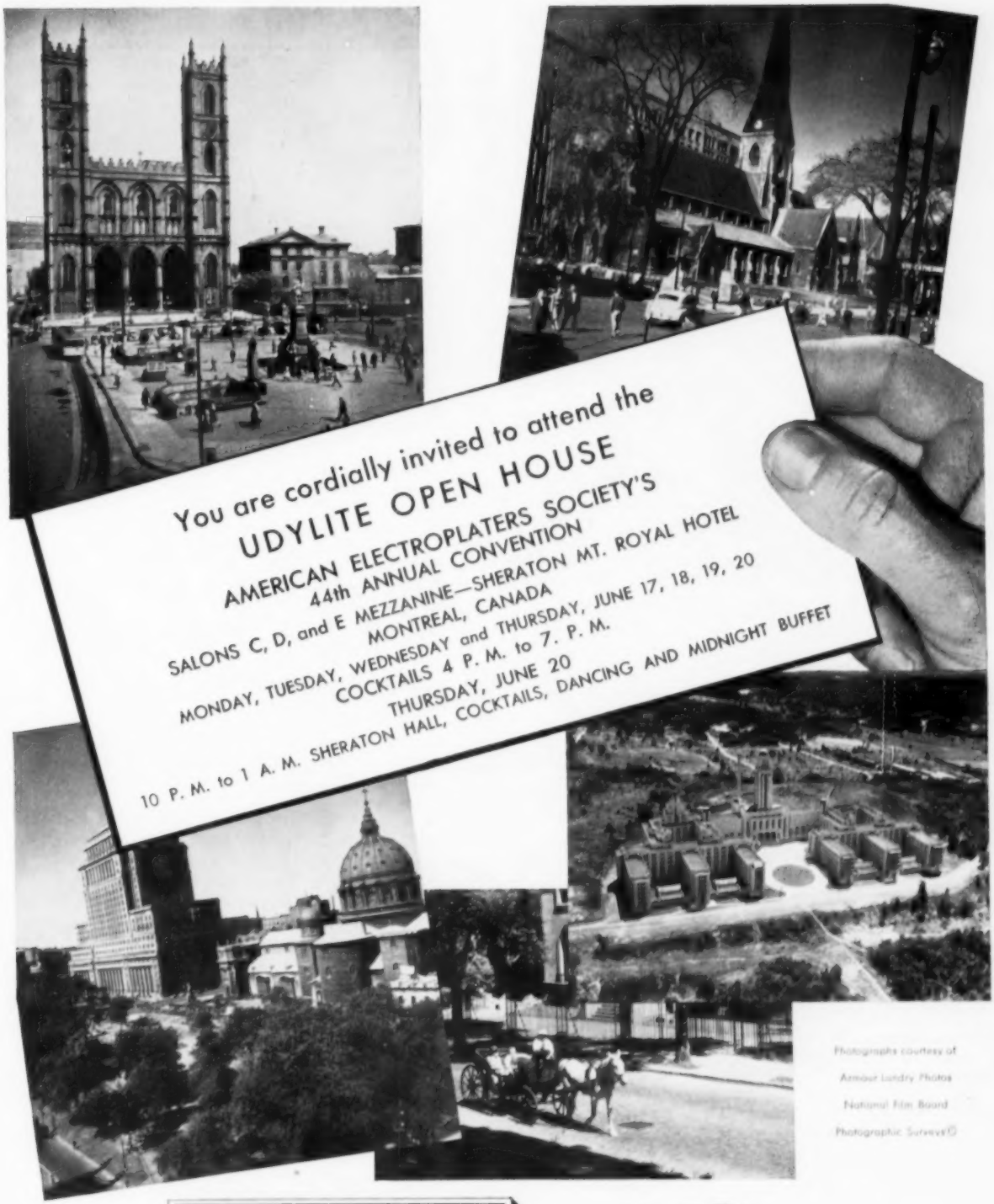
Example 1 is:

$NiSO_4 6H_2O$	100 g/l
Na citrate	66 g/l
NaCl or NH_4Cl	35 g/l
Ethylene diamine tetra acetic acid	20–100 g/l (e.g., 60)
Triethanolamine	35–50 cc (e.g., 40)
$Ni(NO_3)_2$	10–30 g/l (e.g., 20)
*p*H	6.5–12 (e.g., 7.0)
Current density	40 amp/ft²
Temp	140 F
$NaHSO_3$	3–8 g/l (e.g., 5)

5 claims.

No. 2,773,819, December 11, 1956—Electrodeposition of Lead—L. Gianelos, assignor to The Harshaw Chemical Co., Cleveland, Ohio.

A lead fluoborate solution containing addition agents to sup-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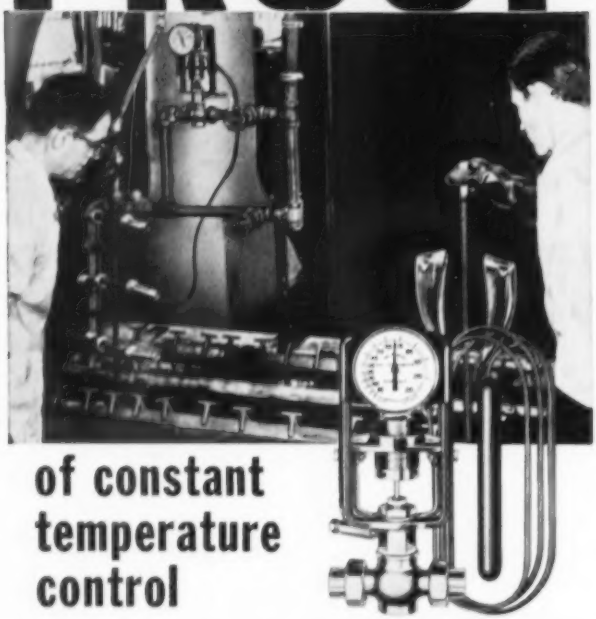

of constant temperature control

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Simple, compact, and dependable, the Powers No. 11-MF Self-Operating Temperature Regulator assures quality finishes with a minimum of waste. With accurate control of temperatures, your processes can be operated at their most efficient level without danger of costly overheating. Being self-operated, the No. 11-MF requires no external power source.

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POWERS

TEMPERATURE CONTROL

PATENT ABSTRACTS

press tree formation is claimed. Aloin and dibenzene sulfonamide are mentioned.

Example I is as follows:

$Pb(BF_4)_2$	g/l	250
HBF_4	g/l	80
H_3BO_3	g/l	22.5
Aloin	g/l	0.2
Dibenzene sulfonamide $(C_6H_5SO_2NHSO_2C_6H_5)$	g/l	1.0
Cathode current density (ASF)		30

5 claims.

No. 2,773,820, December 11, 1956—Electrolytic Process for Salvaging Uranium—R. Boyer and S. Kilner, assignors to the United States (AEC).

An electrolyte method for concentrating uranium ions is described.

7 claims, figure.

No. 2,773,821, December 11, 1956—Composition for Use in Electropolishing—G. Smith, assignor to Electro-Gleam, Buffalo, N. Y.

The single claim describes the invention as: "A solution for use in electropolishing metals of a group consisting of iron, aluminum, nickel and alloys thereof, said solution containing from 30 to 40 per cent of orthophosphoric acid, 25 to 35 per cent of sulfuric acid and 10 to 20 per cent of hydroxyacetic acid, 5 to 25 per cent of benzene sulfonic acid, 2 to 12 per cent of toluene sulfonic acid and from 5 to 15 per cent of water."

No. 2,774,678, December 18, 1956—Preparation of Metal Sheet for Enameling—C. Rodman, assignor to Alliance Ware, Inc., Del.

The surface of an iron sheet is bombarded by fine metallic shot much harder than the sheet and pot-marks the sheet after which the sheet is enameled.

5 claims, figure.

No. 2,774,683, December 18, 1956—Method of Preparing Magnesium for Reception of Nickel Electroplate—H. K. DeLong, assignor to Dow Chemical Co., Midland, Mich.

Magnesium and alloys thereof containing at least 85 per cent magnesium are made receptive to nickel plating when treated with an aqueous solution containing 30 to 100 g/l of copper sulfate and 6 to 30 g/l of chromic acid to form a copper coating on the article. After rinsing the article is immersed in a solution of aqueous acid fluoride, 17 to 280 g/l, rinsed and plated with nickel.

4 claims.

No. 2,774,686, December 18, 1956—Hot Dip Aluminum Coating Process—A. Hodge, assignor to Kaiser Aluminum and Chemical Corp., Oakland, Calif.

By adding an alkali metal (sodium, potassium or mixtures of the two) to a molten aluminum bath it is claimed that upon hot dipping articles can be coated at a faster rate, the coating is smoother than aluminum baths without the alkali metals and the bath life is extended.

13 claims.

No. 2,774,688, December 18, 1956—Nickel Plating by Chemical Reduction—R. Girard, Chicopee Falls, Mass.

An electroless nickel plating bath is described as a controlled nickel sulfate solution containing 80 g/l of nickel sulfate, 24 g/l of sodium hypophosphite, 12 g/l of sodium acetate, 8 g/l of boric acid and 6 g/l of ammonium chloride.

2 claims.

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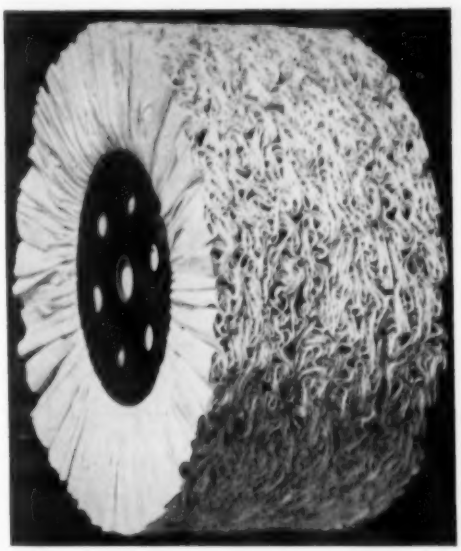

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Manufacturers report that results with this new No. 300H15 are better finish with higher color on stainless, copper, and zinc die castings.

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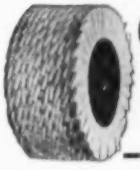

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No. 2,774,696, December 18, 1956—Oxalate Coatings on Chromium Alloys—R. Gibson, assignor to Parker Rust Proof Co., Detroit, Michigan.

Chromium or chromium-nickel -iron alloys are brought into contact with an aqueous solution containing iron oxalate and chloride ion wherein the ferrous ion is in the range of 0–0.8 per cent and the total iron is at least 0.5 per cent. The chloride ion is proportional to the chromium content, e.g., 1 per cent chloride at 15 per cent chromium and 11 per cent chloride at 100 per cent chromium.

2 claims.

No. 2,774,728, December 18, 1956—Addition Agent for Copper Plating—C. Wernlund, assignor to E. I. duPont de Nemours and Co., Wilmington, Del.

A copper plating bath for depositing bright, ductile copper is described as containing 5 to 20 oz/gal of copper cyanide, about 0.006 to 0.06 oz/gal of potassium antimonyl tartrate and methylene—bis(naphthalene sulfonic acid).

The second claim describes a bath containing antimony and alkali metal thiocyanate (0.05 to 10 oz/gal).

10 claims.

No. 2,774,729, December 18, 1956—Recovery of Uranium by Electrolysis of Fused Bath—G. Meister, assignor to USA (AEC).

A uranium halide is dissolved in a fused barium fluoride-barium chloride electrolyte and electrolyzed at 1150 C.

3 claims.

No. 2,775,531, December 25, 1956—Method of Coating a Metal Surface—E. Montgomery, et. al., assignors to Ohio State University, Research Foundation, Columbus, Ohio.

Small particles of metal (al, Fe, Ni, Co) and a metal oxide (alumina, magnesia, zirconia) are mixed together, sintered, then reduced to very small size. The sintered particles are flame sprayed on the surface to be coated, the powder being heated to at least 2100 F.

3 claims.

No. 2,775,535, December 25, 1956—Treatment of Tinplate—W. Poole, assignor to Bethlehem Steel Co., a corporation of Pennsylvania.

Heat the electroplated tin strip to a temperature above the melting point of tin, then clean cathodically in an aqueous sodium carbonate solution (0.5 to 5.5 per cent) at 3–30 asf at 160 to 210 F for more than ½ second, then pass the strip through a chromic acid solution (0.1 to 1.0 per cent) at 150 to 200 F. Finally rinse.

5 claims.

No. 2,775,552, December 25, 1956—Continuous Process for Reducing Uranium in Solution—R. Boyer, assignor to the United States (AEC).

The UO_2^{++} ions in 3 N HCl solution are reduced to U^{++++} and metal by electrolysis using a mercury cathode.

3 claims.

No. 2,775,553, December 25, 1956—Electrolytic Etching Process—G. Kahen, assignor to Sprague Electric Co., North Adams, Mass.

The effective surface of tantalum can be increased by anodic treatment with at least 2 amp/sq in in an aqueous solution of 38.4 to 48 per cent hydrofluoric acid and up to 20 per cent of an anion selected from chloride, bromide, nitrate and sulfate.

2 claims.

Another fine product made finer
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"To achieve a fine finish on beautiful sterling silver flatware, you start with a smooth, uniform surface," says Gorham Mfg. Co., leading silver–and goldsmiths. "To eliminate major defects in the metal before final finishing, we've found that the most efficient method is to use Paramount Felt Bobs with a mixture of fine pumice and oil. Paramount felt wheels and bobs are ideal for polishing flatware and holloware. Easily formed and having an affinity for pumice and oil, they produce a better surface than any other buff."
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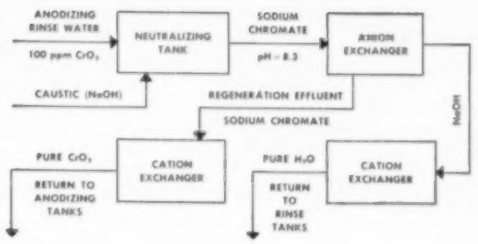
ionXchange



RECOVERY OF CHROMIC ACID FROM ANODIZING RINSE WATER

The block diagram above indicates one method of using ionXchange to save money, in the plating rooms of a large automobile plant, by recovering the chromic acid from the rinse tanks of anodizing operations. The cost of equipment was much less than the cost of a disposal plant, and the savings through recovery were substantial enough to make the investment a very profitable one.

REMOVAL OF ALUMINUM FROM ANODIZING BATH

A secondary purpose for one part of the same installation was the removal of aluminum from the anodizing baths. When the concentration of aluminum in any anodizing tank rose to nearly 1 g. per liter, that tank was cycled through the cation exchanger and the aluminum removed, thus saving over $250 a week compared with partial dumping. *For details on this and many other money-saving applications of ILLCO-WAY ionXchange, write us or consult your Illinois Water Treatment Company representative.*

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PERMA BLACK—process for blacking stainless steels, cast iron, malleable iron and other steels; temperature range 245–250° F.

LUSTRE BLACK—process blacking bath for ferrous steels at 280–300° F., single tank operation.

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ESTOX 12 HEAVY DUTY FERROUS SOAK CLEANER—for cleaning before electroplating. Excellent oil and dirt removal. Long life.

ESTOX 8 MAGNESIUM SOAK CLEANER—a carefully compounded formulation for soak cleaning magnesium and spray stripping paint.

ESTOX 28 BARREL FINISHING COMPOUND—for barrel burnishing brass, copper, nickel, silver, gold. Maximum lubrication and free rinsing eliminate spotting from hard water—give uniform results.

ESTOX 110 WASHING MACHINE CLEANER—a superior cleaner for all industrial washing machines.

ESTOX 124 DRY WALL PAINT BOOTH COATING—for facilitating removal of lacquer, shellac, varnish, or enamel over-spray from paint booth walls. Eliminates scraping. Non-toxic.

ESTOX 130 PAINT DEFLOCCULATOR—to keep headers and nozzles in paint booths open for maximum atomization. Water soluble.

ESTOX 150 GLASS CLEANER—A combination of alkaline salts and wetting agents with additives to remove tarnish from sheet or plate glass.

ESTOX 163 PHOSPHATE COATING—to clean and coat iron phosphate on ferrous materials. Fine grained for ideal paint base.

ESTOX 170 DEOXIDIZER AND BRIGHTENER—designed to deoxidize aluminum or brighten copper and brass. Easily handled in dry form. Non-hazardous.

ESTOX 193 RUST PREVENTATIVE—a new product to prevent rusting of ferrous materials. Extremely economical to use.

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INDUSTRY NEWS

Graver Has New Canadian Representative—Taylor Engineering and Construction Co., Ltd., 111 Stephenson Avenue, Toronto 13, Ontario, has been appointed engineering sales representative for Graver Water Conditioning Co., New York.

The territory to be handled for Graver by Taylor will consist of the Toronto area, including the majority of the Province of Ontario to the west of Toronto.

Taylor Engineering has been in existence for 25 years and has been a factor in the industrial growth of Canada. They will handle Graver's complete line of industrial and municipal water treatment equipment and industrial waste treatment equipment.

Reynolds Plans Research Center—Reynolds Metals Co. is holding options on approximately 55 acres of land in the southeast corner of the intersection of the Inner Belt Expressway and Newburg Road in Louisville, Ky.

On the site the company plans a landscaped product research and development center and an office building. The proposed center would employ initially about 200 research scientists and development engineers and would be the first building constructed. The office building would be the final structure and would eventually employ approximately 2000 sales executives and office personnel. The buildings will be designed by Eero Saarinen, whose accomplishments include the General Motors Technical Center.

Sel-Rex Opens West Coast Office—A branch office and warehouse in Los Angeles has been announced by Sel-Rex Corp., Nutley, N. J., manufacturers of precious metals processes, metallic power rectifiers, ground and airborne d-c power supplies, and metal finishing equipment and supplies.

The new office is located at 2054 Granville Avenue—in the heart of Los Angeles' electronic industry—and incorporates vault facilities for storage of gold, rhodium and other precious metals salts and solutions, assuring prompt deliveries to west coast customers. A factory trained service engineer is to be assigned to the completely staffed offices to provide installation services and to assist in the solution of customers' technical problems.

In addition to Sel-Rex precious metals processes, the new west coast offices will provide direct factory sales and service representation on Sel-Rex rectifiers, liquid clarification filters, and the portable automatic "Jet (electro-) Plater."

In addition to the new executive offices in Nutley, branch offices and warehouses are maintained in Detroit and Chicago.

According to Morris M. Messing, Sel-Rex president, the new Los Angeles office is another step in his firm's expansion program. This program has already entailed the addition of three branch offices in three years, the appointment of many new distributors and manufacturers' agents, and three executive offices and main plant moves to successively larger quarters.

On a tour of the U. S., Rolf Bergvall (third from left), technical manager of Kemiska AB Candor, Swedish manufacturer of metal finishing supplies recently licensed to manufacture Iridite chromate conversion coatings and ARP plating chemicals for the Scandinavian countries, visited the Iridite installation at the National Lock Co., Rockford, Illinois. Inspecting samples of National's work are: A. L. Poe, district sales manager for Allied Research Sales Corp.; Bill Geissman, National's assistant superintendent, Finishing Division; Mr. Bergvall; and Len Weeg, superintendent, National's finishing division. Mr. Bergvall spent many weeks of orientation and training at the Baltimore home office and laboratories of Allied Research.

New Trademark Adopted by Diamond Alkali—Diamond Alkali Co., Cleveland, Ohio, has adopted a distinctive new trademark to identify its corporate organization and chemical products.

The new mark, called the "Chemical Diamond," has been designed to provide originality and visual recognition values that will make it "an effective aid in product selling, merchandising, advertising and public relations by creating new, instant-identification impact for the company in the eyes and minds of customers, suppliers, stockholders, employes and the public."

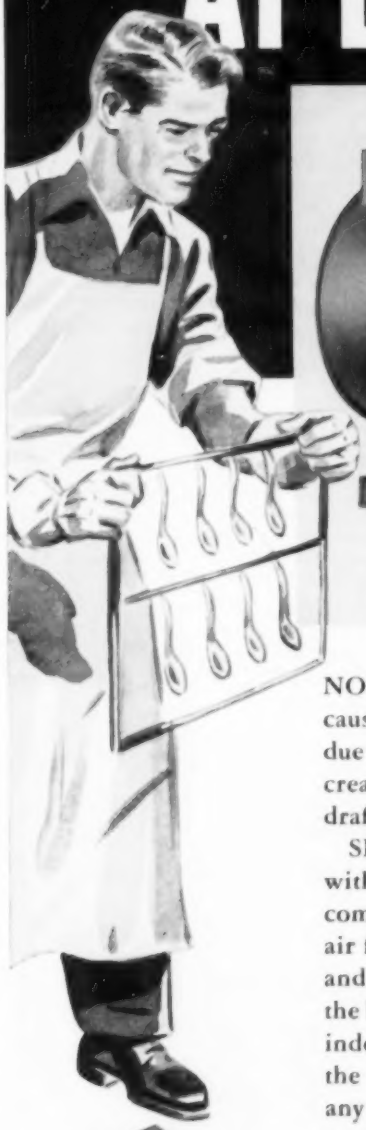
The emblem suggests both the letter "d" for Diamond and a chemical retort, traditionally regarded and widely accepted as a graphic symbol representative of the chemical industry.

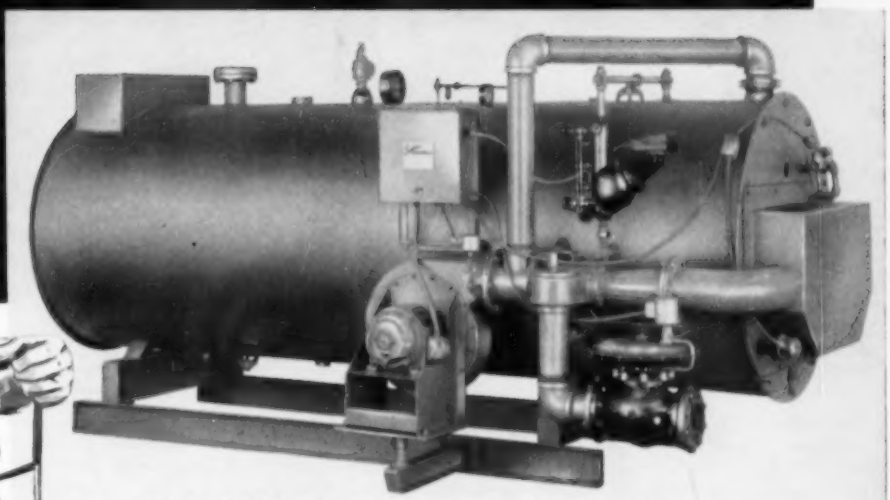
New Distributors for Alpha Plastics—Alpha Plastics Inc., Livingston, N. J. has appointed six stocking distributors.

In carrying Alpha's entire line of polyvinyl chloride pipe, fittings and valves, the new distributors, Mayer-Malbin, Astoria, L. I., N. Y., John Wilfert Inc., Brooklyn, N. Y., Ward Bros. Mill Supply, Lockport, N. Y., J. Heller & Sons, Newark, N. J., Keenan-Cashman, Bayonne, N. J., and Missouri-Kansas Supply Co., Kansas City, Mo., will be able to offer a complete PVC package for handling corrosive fluids.

Kosmos in Larger Quarters—The firm of Kosmos Electro-Finishing Research, Inc. has settled in its own permanent quarters at 140 Liberty Street, Hackensack, N. J. where they now have ample facilities to conduct expanded research and development in metal finishing, with increasing attention to chromate con-

AT LAST A BOILER DESIGNED FOR THE PLATER!





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NOW—No more foul fumes because of incomplete combustion due to back draft through boiler created by exhaust fans or poor draft conditions.

SELLERS solves this problem with the improved design, closed combustion chamber boiler. All air for combustion, both primary and secondary, is pushed through the boiler under positive pressure, independent of partial vacuum in the building and independent of any back draft on the chimney (of course, products of combustion must be removed from building).

A positive pressure blower supplies air under pressure which is mixed with the gas and passed to burners in the completely closed combustion chamber; to complete combustion, secondary air is fed into the closed chamber under positive pressure (many times greater than the vacuum in the building). By this method of securing positive complete combustion, burned gases are pushed through the boiler and FOUL FUMES ARE ELIMINATED.

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NEW KOSMOS PLANT—(Top left) John Kosmos in his laboratory. (Top right) Front of the plant. (Bottom left) Rear view showing shipping facilities. (Bottom right) Expanded storage Space.

version coatings. The new building houses a warehouse, laboratory and pilot plant.

John Kosmos founded the company at its prior location in Belleville, N. J. about two and one-half years ago. He previously had been for five years chief chemist and field consultant with The Chemical Corp., Springfield, Mass.

The company represents manufacturers of equipment and supplies, such as rectifiers, barrel and tank installations, in the metal finishing industry. It maintains engineering consultant services and operates nationally and internationally, with distributors of its own products in major cities.

Oakite Makes Service Award—John Mackesy, one of the San Francisco representatives of Oakite Products, Inc., for the past 16 years, has been selected as the winner of the 1956 David C. Ball Award for Distinguished Oakite Service. The award, established in memory of the founder of the industrial cleaning and metal treating firm, is given annually to the representative who "best carries forward with his customers the highest ideals of Oakite Service."

Mr. Mackesy, a native of Dublin, Ireland, has been with Oakite since 1939, covering the San Jose area before moving to San Francisco. He received the award from John A. Carter, company president, at the firm's recent anniversary conference in New York City.

External House Organ Issued by Promat—The Promat Division—Poor & Co., Waukegan, Ill. is publishing, monthly, a new controlled-circulation magazine named Promat's Progress. This external publication is to be sent to persons in the metal finishing field who are interested in the hot-dip, electroplating and electrogalvanization processes.

Promat manufactures chromate finishes, acid additives and processes used in the finishing and anti-corrosive protection of metal.

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INDUSTRY NEWS BRIEFS

● The first meeting of the newly-formed nickel plating industry Advisory Committee was held April 30 by the Business and Defense Services Administration, U. S. Department of Commerce.

BDSA officials informed the Committee that distribution of nickel to platers by plating supply houses is now being carried out in general accord with principles stated by the Commerce Department in its reports to the Congress of December 31, 1956, and February 15, 1957.

BDSA representatives told the platers that, as a result of meetings which the agency has held individually with the management of each of the plating supply houses, adherence to the principles of fair and equitable distribution of available nickel supplies to all plating consumers will be followed. The measures provide, among other things, assurance that users of small quantities of nickel for plating will in the future receive full shares of the available metal.

The demand for nickel probably will exceed the total amount available to United States consumers until 1959 or 1960. Additional production is expected, however, during the present year from the government-owned Nicaro project in Cuba. Some of it will be available for distribution to the plating industry through the nickel plating supply houses.

● Mine production of nickel in the free world continued its uptrend for the sixth consecutive year to establish a new high of about 231,000 short tons in 1956, up to about 7 per cent over 1955, according to the Bureau of Mines, Department of the Interior. Of the 1956 total, Canada produced about 77 per cent, Cuba 7 per cent, and the United States 3 per cent. Despite the diversion to industry of 77.5 million pounds from scheduled shipments to the government stockpile, the shortage of nickel for civilian needs continued in 1956.

Total consumption of nickel was 127,578 short tons in 1956, compared with 110,100 tons (revised figure) in 1955. Of the 1956 total, 39 per cent was utilized in stainless and engineering alloy steels. Usage of nickel in stainless steel was 24 per cent larger than in 1955 but that for engineering alloy steel was 8 per cent smaller. More nickel was also used in cast irons, high temperature and electrical resistance alloys, non-ferrous alloys, electroplating, catalysts, ceramics, and magnets.

Domestic production of nickel established a new high in 1956, chiefly as a result of greater output from the deposit at Riddle, Ore.

The six-year uptrend in imports of nickel into the United States was halted in 1956; however, they were only 0.3 per cent less than in 1955. Canada and Norway supplied 87 per cent of the 1956 total; the nickel imported from Norway was produced from Canadian ore.

● The use of silicon, the electronic metal which makes possible better transistors, rectifiers, computers and instruments, will increase from 10,000 lbs. in 1956 to an estimated 100,000 lbs. in five years, according to a 20 page monograph just issued by Aries Laboratories, Inc.

The ultra pure (99.999 per cent) silicon will be used in a myriad of applications.

The bulletin entitled "The Relation of Silicon and Its Properties To The Electronics Industry," describes the characteristics of silicon in rectifiers, solar batteries, transistors, etc. and the methods of device fabrication.

● Ground was broken for a $1,100,000 building addition at Armour Research Foundation of Illinois Institute of Technology, Chicago on Thursday, May 9.

The four-story addition is being constructed at the north end of the Metals Research Building. Rapid expansion in metals research has necessitated construction of the 144-addition. This is the second step in a $5 million expansion program initiated by the Foundation in 1956.

The addition is expected to be completed by late fall. New research equipment, valued at approximately $175,000, will bring the total installation cost to in excess of $1,275,000.

Costs of Plating

●

Accountants have a jargon all their own which sounds very impressive to the uninitiated. Platers have a pattern of conversation that must sound strange to the accountants. Still the plater should know something about cost accounting.

●

Barrel nickel plating costs can be figured in many ways. Consumption of nickel can be calculated by using 1 pound of nickel for every 400 ampere hours. Power costs can be simply calculated. Solution costs can be approximated by keeping track of additions or by using a rough figure of 10-15% of the solution being dragged out in 40 hours.

●

Overhead factors are often the deciding ones so far as profit goes. Addition agents can be figured as a direct cost. But the time required to make the additions and chemical time required for checking the solution are part of your overhead.

●

True Brite Barrel Nickel Process uses only one brightener. It is simple to add and requires no complicated laboratory control. It is designed for barrel nickel plating. Whenever you are confronted with modified still tank bright nickel processes with their multiple system of addition agents add up the cost of the additions and checking. Then add up the rejects as a result of unbalanced additions.

●

We think you too will agree after you've considered all the factors that True Brite Brightener is the best for barrel nickel plating. Ask the man who uses it.

TRUE BRITE CHEMICAL PRODUCTS CO.
98 FALLS AVENUE OAKVILLE, CONN.

PERSONALS

Bergin

Horelick

Francis X. Bergin has been appointed product manager for The Lea Manufacturing Co. He will be in charge of all sales and services on liquid abrasive compounds for polishing, buffing and burring, and related spray buffing equipment, for both Lea of Waterbury and Lea of Michigan. Mr. Bergin will supervise the activities of both the Waterbury and Michigan sales organization where liquid buffing compound applications are concerned.

Jules Horelick has been named staff executive assistant to H. C. Irvin, president of Allied Research Products, Inc., Baltimore, Maryland manufacturers of the Iridite chromate conversion coatings and ARP plating chemicals.

In his new capacity, Mr. Horelick will play a major role in Allied's new and extensive program of product expansion and development and will be directly responsible for market research with relation to new and existing products.

Mr. Horelick has been with Allied since its inception in 1947, his most recent capacity having been as manager of a subsidiary operation, Allied Metal Finishing Corporation. Prior to joining Allied Research he had gained a wide experience in metal finishing through associations with other companies in the field. He is a graduate of the University of Illinois and is president of the Baltimore-Washington Branch of the AES.

Raymond F. Evans, chairman and chief executive officer of Diamond Alkali Co., Cleveland, Ohio, has been elected to the Board of Directors of Ionics, Inc. Mr. Evans joined Diamond Alkali following his graduation from Princeton University in 1931. After serving in various executive capacities he became president in 1947 and chairman in 1954.

Leonard Sax has been elected president of American Buff Co., Chicago.

With broad experience in the practice of law and public accounting, Mr. Sax came to American Buff in 1946. Starting with basics, he familiarized himself with manufacturing operations and procedures in all departments, learning the business thoroughly. His close work with the sales force kept him abreast of the practical problems of the metal finishing trade. At the time of his election as president, Mr. Sax was secretary-treasurer of the firm.

Fred Fulforth, who for a number of years has represented United Chromium and its successor Metal & Thermit Corp. in the Philadelphia area and the Southeast is now located at the Southeastern Regional Office of Metal & Thermit, 565 Western Ave., N.W., Atlanta, Ga. Mr. Fulforth, past AES president and an honorary member of the Philadelphia Branch was recently made an honorary member of the Atlanta Branch and a delegate to the June convention in Montreal.

William E. Zander has been elected to the Board of Directors of Kelite Corporation, manufacturers of industrial chemicals and steam cleaning equipment, according to an announcement made by L. C. Sorensen, Kelite's president.

Mr. Zander is a director of Arrowhead and Puritas Waters, Inc., and was formerly senior vice president and director of Rheem Manufacturing Co.

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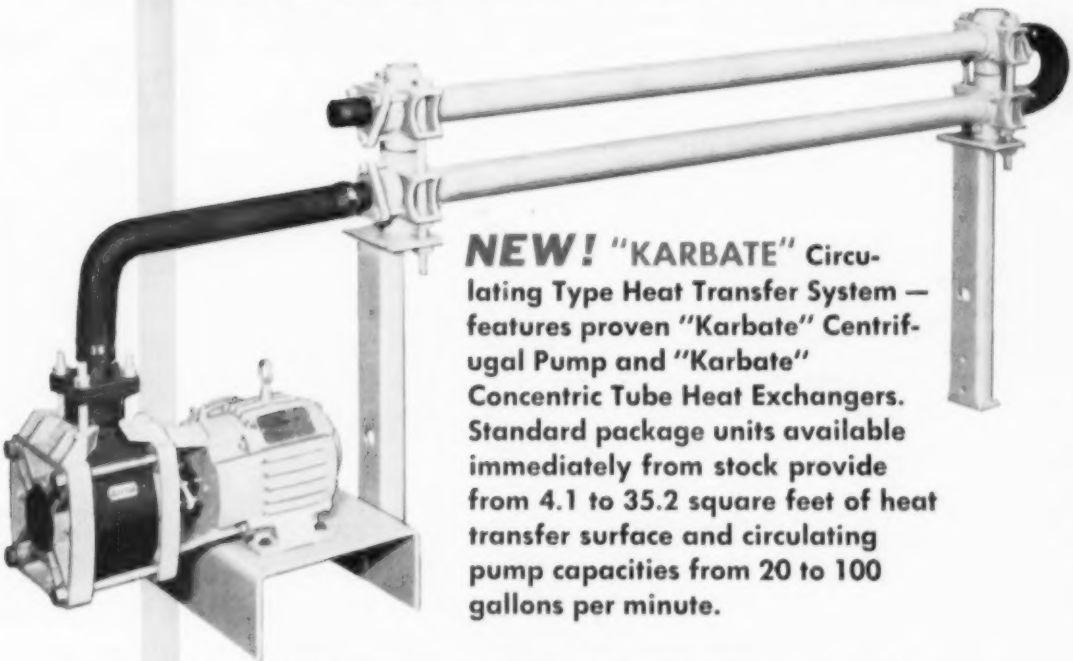

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PERSONALS

Banks

Couch

Dr. F. A. Lowenheim has been named technical advisor to **Dr. C. K. Banks,** vice president of research and development of Metal & Thermit Corp., Rahway, N. J.

Dr. Lowenheim has been with Metal & Thermit since 1936 as a research chemist and research supervisor. He holds a PhD degree from Columbia University where, from 1930 to 1934, he served on the staff as an assistant in chemistry. From 1951 to 1955 he was associated with Stevens Institute of Technology as a visiting lecturer in chemistry.

He is the author of a number of papers and handbook chapters on electroplating and is a member of the American Chemical Society, the Electrochemical Society, the AES, the National Association of Corrosion Engineers and other associations in the chemical and metal finishing fields.

R. W. Couch has been made manager of electrochemical research and development by Metal & Thermit.

Mr. Couch is a graduate in chemistry of Wayne State University. He has been with Metal & Thermit and its former subsidiary, United Chromium, Inc., in various research and supervisory capacities since 1941. In his new post he assumes the overall management of the company's Detroit, and Michigan laboratories.

He is a member of the American Chemical Society and the AES.

Carl R. Gloskey has been appointed to the post of manager of a recently formed Process Development Division of Metal & Thermit.

Mr. Gloskey is a graduate chemist of Rutgers University and prior to serving in the Air Force in World War II was a process control technician with R. L. Walkins Co. He has been with Metal & Thermit's research and development department since 1946.

R. A. Stewart has been named a sales engineer for Metal & Thermit's Chemical, Metals and Plating Products Division. Mr. Stewart is a graduate in chemistry of Indiana University and formerly was with Western Electric Co., Indianapolis as an electro-chemical engineer. He will serve electroplating accounts in the Northern and Western portions of Indiana, operating from the company's sales office at East Chicago.

Nadel

Rodger

Milton Nadel has been appointed general manager of Certified Plating Co., Division of Berkeley Industries, Jersey City, N. J. For the past ten years Mr. Nadel has served as supervisor of metal finishing for Berkeley Industries.

Mr. Nadel is an active member in the AES, having served as president of the New York branch and now is secretary-treasurer.

Stuart W. Rodger has been named to the newly created post of industrial trade sales manager for Formax Manufacturing Corp., Detroit. Mr. Rodger joined Formax shortly after attending Michigan State University. During the past 11 years he has progressed through such key positions as district manager and regional sales manager before obtaining his new promotion. In his new capacity, Mr. Rodger will coordinate nationwide sales of a wide variety of Formax polishing and buffing compounds and buffing wheels, through Formax factory representatives and distributors.

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KELITE CORPORATION

PERSONALS

Merrill

Busby

Henry R. Merrill, since 1955 general sales manager of Behr-Manning Co. of Troy, N. Y., a division of Norton Company, has been appointed vice president in charge of sales.

Mr. Merrill has been a director of the coated abrasives and pressure-sensitive tape manufacturing firm since 1954, and serves also on the directorate of Behr-Manning (Canada) Ltd. Born in Glens Falls, N. Y., he was graduated from Phillips Exeter Academy and, in 1929, from Yale University. He joined Behr-Manning Co. in 1930 and rose through various sales assignments until his appointment in 1953 as assistant general sales manager.

Edward F. Busby has been appointed as a sales representative for Frederic B. Stevens, Inc., Metal Finishing Division.

Prior to joining Stevens, Mr. Busby was a sales representative specializing in cleaners, burnishing materials and paint strippers for nearly two years. Before that he worked a total of eleven years for Bridgeport Lycoming Division of the AVCO Corporation, Stratford, Conn., as plating department foreman and H. B. Ives Company, New Haven, Conn. where he worked up to foreman in charge of automatic buffing, plating and lacquering.

He is a past president of the New Haven Branch of the AES and is presently on the Board of Governors of the branch.

Norman E. Woonton was elected to the newly created position vice president-manufacturing at the annual meeting of the directors of Cowles Chemical Co., Cleveland, Ohio. Mr. Woonton has been manager of Cowles' Skaneateles Falls, N. Y. plant. He will continue in this position and to make his headquarters there. In addition, he will be in charge of all manufacturing and production operations at Cowles' other plants located at Lockport, N. Y. and Sewaren, N. J.

Woonton

Perkins

Maurice B. Perkins has been appointed manager of Sel-Rex Corporation's new Los Angeles office. Mr. Perkins has held technical sales positions covering the west coast aircraft and electronic component manufacturers for over a decade, and is a familiar figure in this area. Sel-Rex's new west coast manager has also had several years' experience in production and quality control in the electronic and aviation industries, giving him first-hand knowledge of these fields' requirements.

Charles B. Clark has been appointed to represent Frederick Gumm Chemical Company, Inc., Kearny, N. J., in the Western New York territory. Mr. Clark lives in Pittsford, N. Y. Gumm has appointed AES member **Albert G. Fusco** to represent them in the Southern New Jersey territory; he will continue to represent the firm in New York City.

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5. Fine grained, dense, ductile deposit—fully bright coming out of the bath, easily buffed if your job is steel.
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Of course, Wagner ISO-BRITE Copper costs no more than competitive copper solutions—yet it saves money in every way while producing vastly higher quality. We can't hope to have you accept all we claim here; we offer the proof of the pudding. Wire, phone or write for Bulletin 70.2 and the name of the Wagner man in your area.

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L—601. Technical Data Sheets—A new liquid acid metal stripper is fully described in Technical Data Sheet No. 46, a two-page usage and instruction sheet prepared by MacDermid Incorporated. Called Metex metal stripper SS, the new material is an immersion strip requiring no current, and permits the stripping of all commercially plated coatings—except chromium and certain precious metals—from stainless steel or aluminum. Metex SS stripper, a prepared solution used full strength at room temperature, requires little control and does not etch stainless steel or aluminum. It can be used as a rack strip, eliminating mechanical rack stripping entirely.

A general purpose cleaner to remove oils from steel, brass and base metals is fully described in Technical Data Sheet No. 47, Metalex W Special is mildly alkaline and has a high percentage of wetting agent. Compounded to counteract hard water effects, it is a free rinsing cleaner and tolerates prolonged transfer periods. It can be used as a soak, direct or reverse current cleaner, and activates bright nickel plate or buffed nickel before chrome plating.

Compounds for burnishing all basis metals are fully described in Technical Data Sheet No. 49. Compounded to give maximum luster in open or closed barrels, with or without hardened steel burnishing balls or stones, these compounds reportedly will not discolor or pit burnishing balls, if used, and give desired brightness in short operating time.

Two acid electrolytic strips are fully described in Technical Data Sheet No. 20. Both strongly acidic solutions, these strips are used with current, and will not attack base metals. Used to strip chromium, nickel, copper or bronze plate from zinc base diecastings, Metex DB strip also strips nickel plate from brass; and copper, nickel or chromium from aluminum.

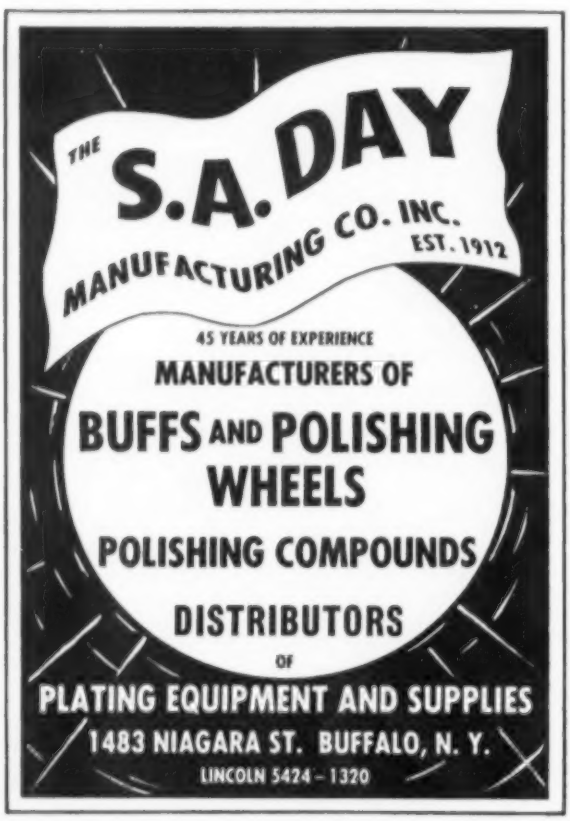
L—602. Valves and Fittings—A new 16-page illustrated bulletin which describes Walworth polyvinyl chloride (PVC) valves and fittings has been issued by the Walworth Co. PVC valves and fittings, offering exceptional resistance to most salts, alkalis and acids, are designed for piping systems where piping corrosive fluids present a problem.

The bulletin presents four pages of application tables on the performance of normal impact PVC and high impact PVC valves and fittings for handling about 315 different fluids that attack other materials.

L—603. Barrel Finishing—Case histories of manufacturers using the Honite method of barrel finishing are offered in a new publication by Minnesota Mining and Manufacturing Co.

Examples report overall cost reductions, time savings, and consistently improved finishes.

The 12-page booklet is profusely illustrated with actual before-and-after pictures of a variety of parts, as well as charts indexing types of media and compounds and their uses.



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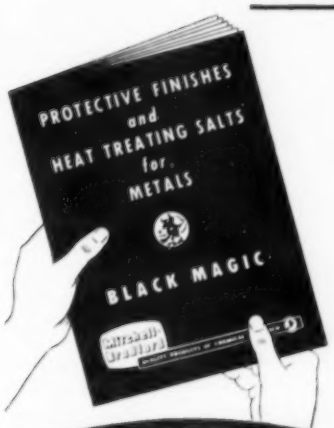

A comprehensive study of the application of a black oxide finish has been compiled and is now available in our latest catalog. The study also covers Black Magic Blackening Processes for other ferrous and non-ferrous metals; metal cleaners, rustproofing oils and waxes, plating specialties and a complete line of heat treating salts.

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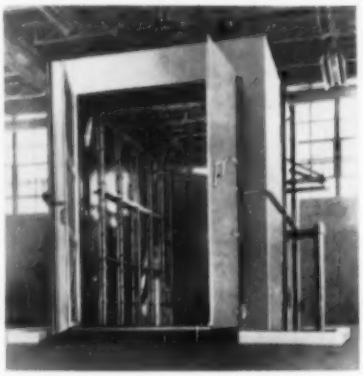
E—601. Washing and Processing Machine—A fully automatic A-F cabinet type machine with its "traveling wash carriage" has been especially designed by The Alvey-Ferguson Co., for cleaning and processing large, odd-size metal products.

For cleaning, the machine is equipped with automatically-timed wash and rinse cycles. These can be pre-set for any desired time periods and the operation is automatic. A signal light indicates when the operation is completed. Cleaned at an elevated temperature, the hot parts or products dry quickly on removal.

Combination cleaning and phosphate coating materials may be used in the wash



tanks and a small amount of chromic acid added to the rinse water provides a basic treatment that makes a bond for paint.

Separate wash and rinse piping assemblies mounted on reciprocating carriages supply full spray coverage from four sides. Individual pump and tank units are furnished for each solution. Solutions are returned to their proper storage tank by automatic drain sheets.

E—602. Plating Filter—Sparkler Manufacturing Co. announces an inexpensive, new 500 gph plating solution filter, complete with pump, motor, and suction and discharge hose.

The unit, called the Plater's-Pal, is sold only through plating suppliers.

The Plater's-Pal handles all acid and cyanide solutions except chromic acid and high chloride nickel.

Though completely enclosed, all operating parts are easily accessible and can be inspected without dismantling the filter. Because only clean solution flows through the pump, there is no excessive pump wear. All solution is reclaimed. The filter can be cleaned and put back in operation in 10 min.

E—603. Tablet Hypochlorinator—Fischer & Porter Co. has acquired from Olin Mathieson Chemical Corp. all sales, development and manufacturing rights to the HTH tablet hypochlorinator, according to an announcement by the two companies.

The tablet hypochlorinator developed

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Now PLASTIC TUBES

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ATLANTIC GREASELESS COMPOUNDS offers a new plastic container, the most modern method of packaging for economy and ease of application. Standard aluminum package and foil lined fibreboard containers available if desired.

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Devoted exclusively to producing unexcelled greaseless compounds, Atlantic maintains constant research striving for continually improved products. Technical assistance and data available upon request.

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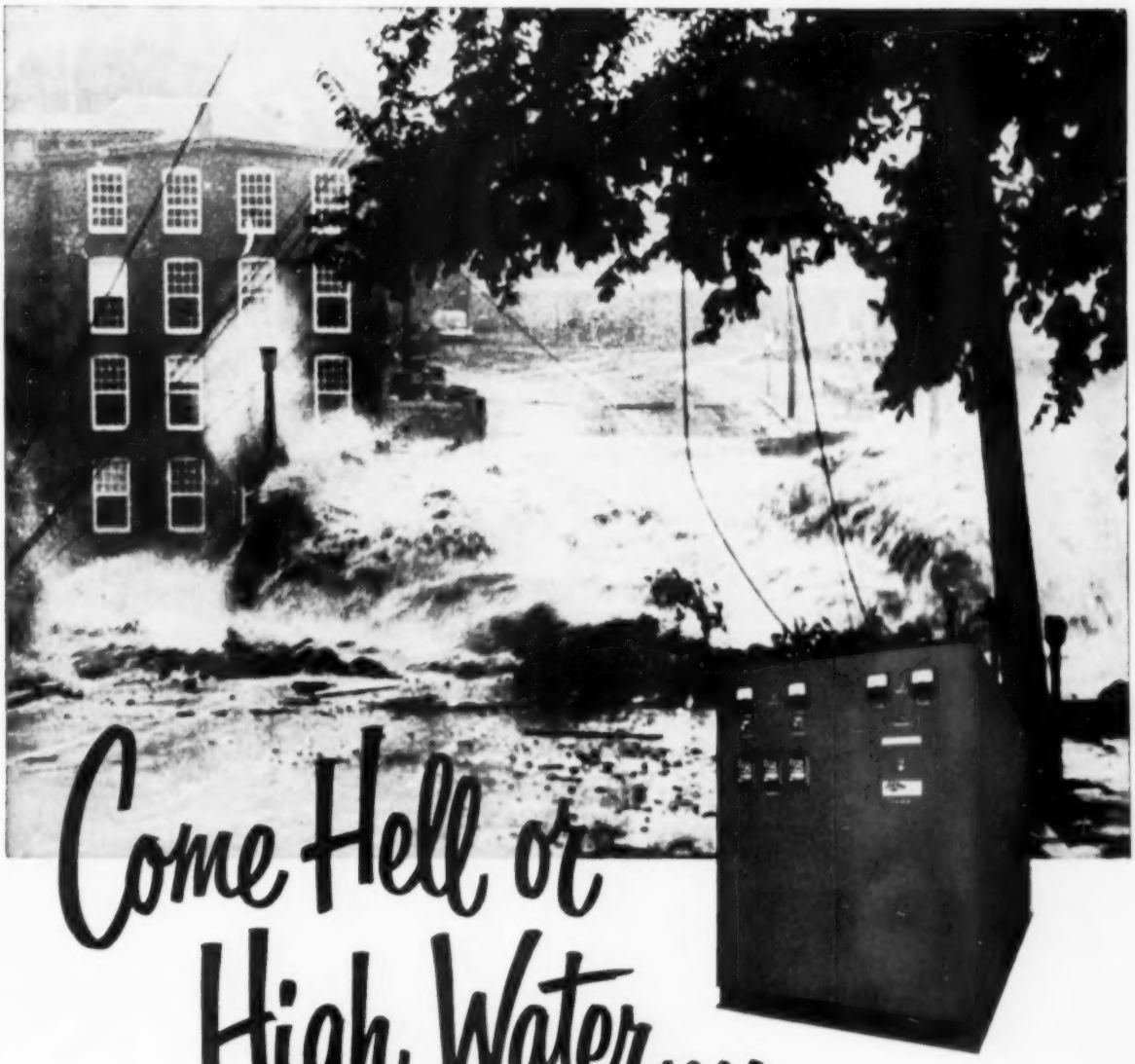

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by Olin Mathieson, is a device for the continuous generation of chlorine solution from calcium hypochlorite tablets. It combines the functions of tablet reservoir, dissolver and metering unit.

Olin Mathieson has turned over to Fischer & Porter its complete background of technical information on the hypochlorinator but will continue to produce and sell the HTH tablets used in the apparatus.

The HTH tablet hypochlorinator is used for chlorinating industrial wastes, sewage and potable water.

E—604. Rhodium Plates of Double Thickness—Rhodium electroplates of at least twice the thickness possible with conventional rhodium formulations are being obtained with Sel-Rex Rhodex, according to an announcement from Sel-Rex Corp.

Originally developed as a rhodium process for the production of compressively stressed electroplate, the extra-heavy deposits possible with Rhodex were discovered during recent experimentation intended to increase the friction-wear resistance of rhodium plated commutator discs and switch plates. Sel-Rex electrochemists state that they have consistently produced Rhodex electroplate in thicknesses exceeding 0.001 in. twice the thickness at which ordinary rhodium electroplate generally fractures and fails. It is reported that the actual thickness to which Rhodex can be successfully plated appears to be limited only by cost considerations.

The manufacturer states that arrangements can be made for electrical or electronic components to be sample-plated with Rhodex, at the cost of rhodium alone.

The cleanliness of the ultrasonic chamber is maintained to a ten micron efficiency through a high flow removable honeycomb filter element. A centrifugal pump provides circulation and spray lance feed.

The ultrasonic chamber is provided with a baffled water cooled jacket to maintain an optimum temperature of 140 F. Self-actuating water control valve controls the water flow accurately to hold the required temperature without attention.

E—605. Stripper for Epon Finishes—Oakite Stripper S-A, a solvent-acid compound designed to strip high-grade epons and other tough finishes, has recently been introduced by Oakite Products, Inc.

Inhibited for safety on all metals except magnesium during the recommended stripping period, Stripper S-A has proved itself in use, stripping finishes impervious to any other stripping agent in just 10 minutes, and removing a wide variety of resistant paints in from 1 to 5 minutes. It is also said to remove light rust, scale and smut deposits.

E—606. Chrome Removal Process—A new process for removing chromium from copper plating baths has been announced by MacDermid Incorporated. Known as MacDermid chrome removal process, it is available for use with the firm's Rocheltex Copper, Standard Bright Copper, and the new high speed Z/T Bright Copper baths. The new process involves treating the copper plating solution with two prepared materials, Metex precipitator and Metex reducer, then carbon treating and filtering. This process results in the complete removal of chromium contamination.

An advantage claimed of the new process is that the additive chemicals do not accumulate to build sufficient concentrations which would form bi-valent copper and create side effects. If recontamination occurs, the process may be repeated without concern for such side effects.

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Provides precise determinations of tensile and compressive stresses in metallic coatings, paints, varnishes, etc.

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Ahco Liquid Buffing Compounds are made with the same high-grade abrasives as Ahco bar compounds, but with an emulsion-type liquid binder. These versatile compounds may be applied in several ways: the work or the buff may be sprayed, or the work may be dipped or brushed before buffing. The amount of compound applied to a wheel or buff can be more easily controlled; buffs run cooler — thus eliminating a fire hazard and lengthening buff life. Work surfaces clean more easily; there are no nubbins left over, so you save compound. AHCO Liquid Compounds are especially suitable for automatic buffing

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DIVISION
HUBBARD-HALL CHEMICAL CO.
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EQUIPMENT & SUPPLIES

E—607. Periodic Reverse Rectifier—A new rectifier designed and built by Sel-Rex Corp., permits periodic reverse operations at greater output ratings than previously available. Developed in conjunction with Unit Process Assemblies, builders of the periodic reverse controls, the new Sel-Rex rectifier is said to eliminate the need for separating tank anodes and cathodes into cells of maximum capacities of 1000-amp each.

This new Sel-Rex rectifier is of special interest to companies doing heavy electroplating or electroforming where periodic reverse or "de-plating" methods are used to eliminate nodules and other irregularities which tend to build up in such operations. It is reported that only one small control panel is needed at the plating tank, regardless of the total amperage of the installation.

The standard Unit Process Assemblies 1000-amp periodic reverse unit is used in multiple sections by the new Sel-Rex periodic reverse rectifier. In a recently completed installation, three 1000-ampere capacity sections are connected in parallel in conjunction with the rectifier which is actually three units with isolated outputs. Voltage is regulated to within 2 per cent. A specially designed magnetic amplifier control circuit maintains a current balance between units within 3 per cent, thus enforcing periodic reverse units to function within their specified ratings—regardless of how many are connected in parallel.

E—608. Desmutting Agent for Aluminum—Cleanite Products Inc. has a new product, Cleanite 8, for processing aluminum. After thorough testing in a number of industrial plants, it is reported Cleanite 8 has proved its ability for long bath life, quick desmutting after alkaline etching, low surface resistance for spot welding, stain removal, and for use prior to chromate conversion coatings.

E—609. Stainless Steel Thermostat—For corrosive applications Fenwal Inc. has added to its line of Thermoswitch units a new thermostat fabricated entirely from 316 stainless steel. For additional corrosion resistance, all exterior joints are heliarc welded. Because of its special construction, model 18000-26 is especially suited for service in 5 per cent H_2SO_4 at temperatures up to 120 F (or in higher concentrations at lower temperatures), acetic acid vapors, halide solutions, alkaline solutions, and other materials to which 316-type stainless is resistant.

E—610. Plastisol Spray Finish—New sprayable plastisol finishes have been developed for use on all types of manufactured metal goods and castings. The vinyl

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coatings can be applied to any metal surface by standard spray finishing apparatus. Two basic compounds are available under the name of Flintlok, and five by the name of Tufkote. Within these categories Auburn Button Works offers a custom compounding service that provides for the modification of these seven basic compounds to meet the exact specifications.

Flintlok 40 locks with a tenacious bond to any metal surface without need for a primer undercoat, and presents a flinty surface extremely resistant to abrasion. Flintlok 41 has the same characteristics but includes a suspension of fine metallic flakes that provides the sparkle of silver or the glitter of gold. Flintlok 42 is also identical to No. 40 but comes in metallic lusters and opalescent sheens of any hue. Flintlok achieves a 95 Durometer on the C scale and is reported not to scratch, chip, crack or peel. These tough finishes also have high resistivity to chemicals of all kinds. They are ideal for application to interiors of storage tanks and all processing equipment subject to corrosion, to shop machinery and many types of industrial apparatus, to appliances, office machines and equipment, carrying cases, metal furniture, toys and all metal products.

E—611. Tab Masks—A pre-cut, self-sticking mask removed quickly and neatly by means of a non-adhesive tab, which is part of the mask, has been developed by the W. H. Brady Co. Originally intended for masking hard-to-reach and recessed areas, the new TAB mask is claimed to speed finishing wherever pre-cut masks are used—spray painting, anodizing, vacuum-metalizing, etc.

The non-adhesive tab folds back out of the way when applied. To remove, it is only necessary to grab the tab and pull. The new Brady TAB mask is said to eliminate all use of tools or sharp instruments often used to remove masks from a finished piece, without danger of scratching or marring a fine finish.

Brady TAB masks are pre-cut in any shape to specifications. They can be furnished in a variety of masking tapes to suit most finishing conditions of temperature, bake cycles and materials.

E—612. White-Lined Tumbler Barrels—New white-lined Mini-Tumbler barrels are being produced by Rampe Manufacturing Co. for production tumbling of small precision parts. Lined with no-seam vinyl plastic, they are claimed to be non-contaminating and resistant to chemicals and abrasion. The white interior with greater light reflection, makes cleanliness visible and easier to maintain.

For bench use, the barrels are available in either open conical or closed barrel types, both suitable for steel ball burnishing.

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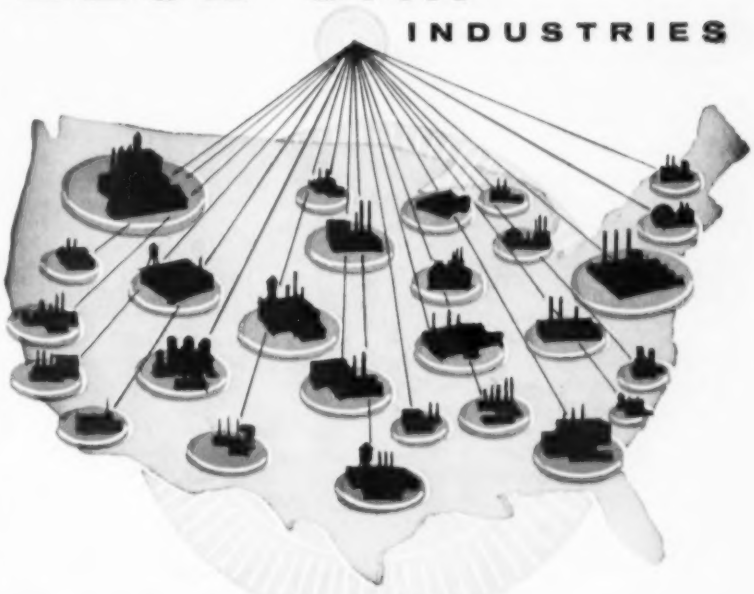

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BOOKS

Remittance must accompany all book orders placed with AES Headquarters.

Finishing Handbook and Directory, 1957. Products Finishing (London). 485 pp. 5½ x 8½ in. Not sold separately. Combined with 12 monthly issues of Product Finishing, 4 Ludgate Circus, London, EC 4, England $5.50, plus $1.00 postage.

The handbook portion of this volume covers the following subjects: Preparatory Treatments (cleaning, stripping and conversion coatings) 30 pp.; Chief Types of Paints (including a section on "Trick Finishes") 18 pp.; Selection of Paint Schemes (for different base materials) 12 pp.; Paint Application Methods, 40 pp.; Paint Tests and Faults, 14 pp.; Refinishing Motor Cars, 10 pp.; Electroplating Plant (engineering) 20 pp.; Electroplating Processes (formulas and operating conditions) 22 pp.; Cures for Faults in Plating Baths, 18 pp.; Treatment of Plating Wastes, 12 pp.; Coloring Treatments for Metals, 10 pp.; Finishes for Aluminum Alloys, 20 pp.; Zinc Coating Methods (including galvanizing, spraying, Sheradizing and paints) 12 pp.; Flock Coating Applications, 4 pp.; Vitreous Enameling, 6 pp.; Transfer and Other Marking Processes, 12 pp.; Vacuum Deposition, 4 pp.; Applied Plastic Coatings, 2 pp.; Bibliography, Tables and Glossary, 11 pp.

The directory portion includes: Equipment, Plant and Materials, 85 pp.; Out-Workers' Services (job shops) 32 pp.; Trade and Brand Names, 22 pp.; Names and Addresses (industrial firms) 20 pp.; Associations and Technical Organizations (British and American) 1 pp.; Subject and Advertisers' Indexes.

This book is handsomely bound and well printed. As may be seen from the foregoing list of contents, it covers substantially every phase of finishing, with excellent arrangement of the material given. The information appears complete and unabridged.

It should be noted that the quantities in the formulas are in terms of ounces per British gallon. Cognizance of this has been given by the publishers on the first technical information page (21) and by the inclusion of a table of "Conversion Factors" on page 292.

The section "Cures for Faults in Electroplating Baths" is quite complete and offers ready clues in running down and eliminating bath troubles. The section on "Trade and Brand Names" is of value to identify British trade names that occasionally crop up in international technical literature.

Your reviewer feels this book to be a valuable addition to the reference library of anyone actively connected with either plating, organic finishing or other branches of coating materials.

Reviewed by I. Wm. Marcovitch.

Corrosion Preventive Additives by E. J. Schwoegler and L. U. Berman of the Armour Research Foundation for Wright Air Development Center. Part 2—PB 121113, 168 pages, $4.25; Part 3—PB 121108, 65 pages, $1.75. Order direct from Office of Technical Services, U. S. Department of Commerce, Washington 25.

These reports are of two parts of a continuing project for the Air Force to develop and evaluate new corrosion inhibitors to replace or supplement petroleum sulfonates. Prevention of corrosion of mild steel and ball bearings in brass containers was one of the main objects of the research.

In part 2, a number of corrosion inhibitors which had previously been shown effective by the Static Water Drop Test were evaluated. Many organic compounds also were screened by a Galvanic Specimen Test in order to discover inhibitors effective for inhibiting corrosion in the bimetallic system 52100 steel-Muntz metal brass. Studies were begun on the mechanism of corrosion inhibition of SAE 1020 steel, and attempts were made to relate effectiveness to the structural and functional group characteristics of the molecules studied. Many organic compounds were synthesized to assist in development of new inhibitors and in the elucidation of the mechanism of inhibition.

Work was continued in part 3 on evaluation of various inhibitors against corrosion of SAE 1020 steel. More than 200 compounds were evaluated in the JAN-H-792 cabinet, 12 of which passed an 100-hour requirement. A study of the mechanism of corrosion inhibition was made on data obtained from the galvanic system tests with a 52100 steel disk and cartridge brass clip.

Manual on Industrial Water. Third Printing. American Society of Testing Materials Special Technical Publication 148-B. Cloth Bound, 502 pages, $6.00; AES members $5.40.

The increase in the use of water for industrial processes makes the latest printing of the Manual on Industrial Water a timely addition to the literature. Sponsored by ASTM Committee D-19 on Industrial Water, the manual contains a complete appendix in addition to a comprehensive discussion of water, its uses, treatment, sampling, analysis, and difficulties caused by it.

The appendix lists ASTM standards relating to industrial water. It contains five methods of sampling, 41 standards, four methods of analysis, three standards for methods of reporting results, six standards for methods of test, a glossary of terms, a list of industrial water requirements and a bibliography.

Included in the latest printing are seven new methods and one important revision. Two additional proposed methods are published as additional information. No changes have been made in the chapters.

Electrodeposition of Titanium: Part 3 by W. E. Reid Jr., J. H. Connor and A. Brenner, National Bureau of Standards for Wright Air Development Center. 18 pages. 50 cents. Order PB 121721 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25.

Electrodeposition of titanium from organic solvents was shown in previous research to be most effective from baths consisting of an ether and a soluble reactive titanium compound such as titanium borohydride. This report describes further study of the baths in an effort to increase titanium content of the alloys over the 6.5 per cent previously obtained. The possibility of using sodium or potassium borohydride instead of lithium borohydride to prepare titanium and zirconium borohydrides was examined. Among new compounds prepared for use in the titanium-aluminum alloy bath were chloroborohydride etherates of titanium. Some work was done on the use of organometallic aluminum compounds in a titanium alloy bath. Codeposition of hafnium and thorium with aluminum from the borohydride bath was studied in comparison with the titanium-aluminum alloys. In addition, a number of reactions between reactive organic compounds and titanium salts were performed in a search for a suitable titanium plating bath.

Simultaneous Polarographic Determination of Cadmium and Tin by G. W. Latimer, C. D. Houston, and K. E. Eubank, Wright Air Development Center. 13 pages. 50 cents. Order PB 121685 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25.

The development of cadmium-tin platings for copper sheets creates a need for better methods of analyzing the plating material. An improved method of polarographic analysis to determine simultaneously the percentage of concentration of cadmium and tin is described in this report. Results were judged according to synthetic standards. Analyses show that very few ions interfere with a determination of cadmium and tin. Ferric iron interfered but was reduced to the ferrous state by the addition of hydrooxylarmine hydrochloride. Results show that this method can be reasonably accurate on a wide range of concentrations.

The Corrosion of Titanium by D. W. Stough, F. W. Fink, and R. S. Peoples, Battelle Memorial Institute, 184 pages. $4.75. Order PB 121601 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25.

The exceptional corrosion resistance of titanium and some of its alloys are presented from results of laboratory investigations and from reports of the behavior of the metal in service. Included are corrosion rates in various environments, a description of industrial and military corrosion experiences with titanium, and the results of fundamental studies of the corrosion and passivating processes on titanium.

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Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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amp/cm². Plating uniformity was determined by autoradiographs, the maximum d-difference ratio for 15 2-inch plates being, on the average, 1.58. Low temperature favored Pu deposition; the best deposits were made at <45° C. Earlier methods were reviewed. (Metallurgical Abstract)

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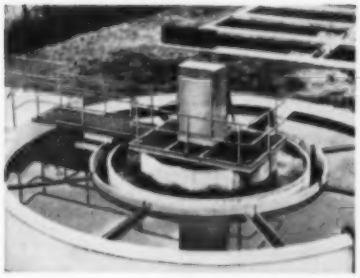

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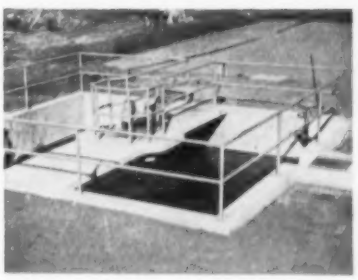

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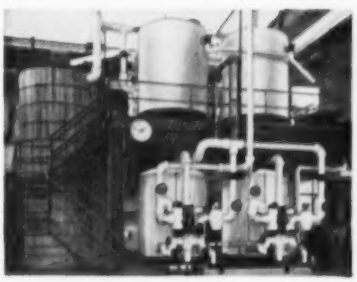

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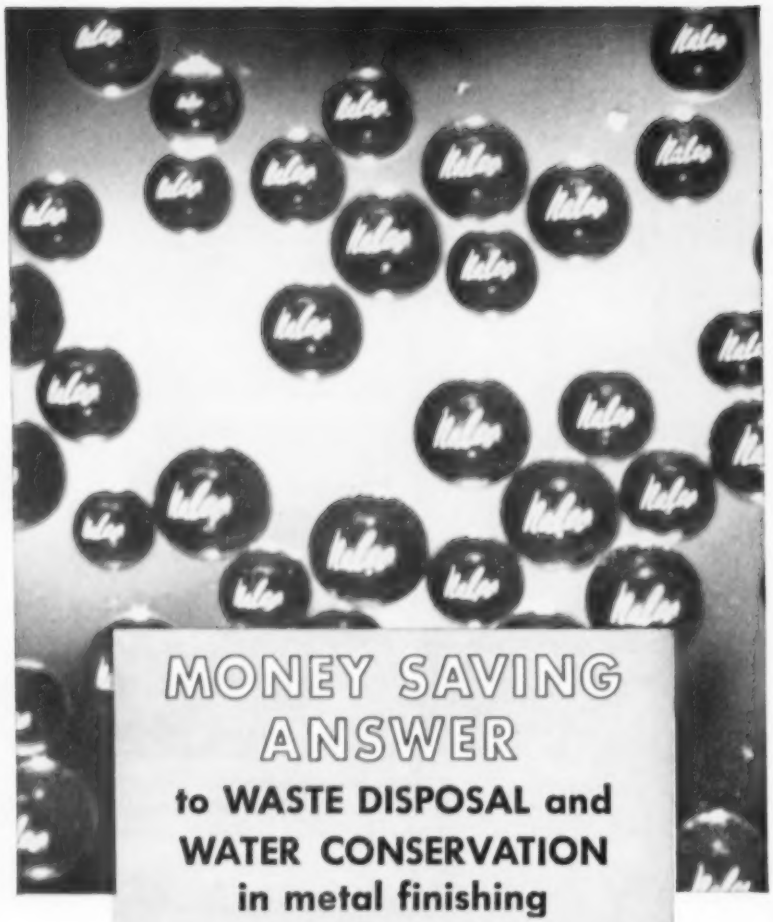

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DEAR SIR:

During my recent trip to the West Coast in which I addressed the five AES Branches, I visited several plating shops in the Los Angeles area. One of these shops was Modern Plating Company which, incidentally, is one of the finest job shops I have ever seen. At the time of my visit, the owner, Mr. Leo Atimion, discussed with me a letter which he was sending out that day to all his customers. I thought it would interest the readers of PLATING and asked for and received his permission to publish it in PLATING.

SAMUEL HEIMAN

(Reprint of Letter)

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Lack of information is frequent cause for delay in completion of work.

We of the plating and related process field feel the urgent need for more accurate and precise information in regard to specifications, type of material to be treated and heat treat, if any.

When a customer calls out a specification, the processor must know the type and class, as well as heat treat. If you do not have the complete information, it is the vendors responsibility to furnish it to the plater.

Example: Material 4130 Steel
Cadmium Plate QQ-P-416
Type II
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BIBLIOGRAPHY ON METAL FINISHING WASTES, 1955

by C. F. Gurnham and D. G. Foulke

THIS LISTING was originally prepared for the annual meeting of the National Technical Task Committee on Industrial Wastes, December 1–2, 1955. It has been revised to include all papers known to us to have been published during 1955. Additions to the list will be appreciated.

No attempt has been made to include general articles on industrial wastes unless metal finishing wastes are discussed in detail. Organic finishing wastes are not included. Analytical methods for metal ions are not included unless the articles relate specifically to effluents from metal finishing operations (the analysis of cyanide is, however, included).

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Registration will commence in the Ballroom of the Convention Hotel at 1 p.m. Sunday, June 16, and will continue daily through the Convention.

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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, May 1, 1957—56.

BALTIMORE-WASHINGTON

Huston Inducts Heiman At Annual Social

The annual meeting of the Baltimore-Washington Branch was held in the Gold Room, Park Plaza Hotel, Baltimore, Maryland, on Saturday evening, April 6, 1957.

This year, as an experiment, the meeting was strictly social. Festivities began with the opening of a cocktail bar followed by a roast beef dinner. With dinner finished we had the pleasure of witnessing **Ken Huston** induct our guest of honor, National President **Dr. Samuel Heiman** into the Order of Past Presidents. Next came an excellent floor show and then we had the drawing of the stubs for the door prizes.

Thanks to the generosity of our suppliers and other establishments there were plenty of door prizes.

The balance of the evening was spent in dancing and good-fellowship.

Attendance was 118, including Dr. and Mrs. Heiman and other guests.

BOSTON—ANNUAL SESSION

The Statler Hotel in Boston, Massachusetts, on May 4, was the scene of the twenty-first Annual Technical Session and Banquet of Boston Branch, attended by 500 members and guests.

The afternoon technical session was chairmanned by F. Wayne Martin, Branch librarian. He extended a warm welcome and, in turn, introduced each of the speakers.

Dr. Samuel Heiman, AES national president, was present and spoke briefly preceding the presentation of three technical papers.

Dr. Heiman said that the past year had been one "of great development and progress in Society affairs." He touched briefly on his recent trip to the West Coast where he found "a growing electroplating industry" and was "glad to note the AES in that area is growing with the industry on the West Coast."

E. C. Rinker of Sel-Rex Precious Metals presented the first paper, "New Developments in Precious Metal Plating." Illustrated with slides, his paper interestingly covered compressively-stressed, crack-free rhodium deposit for the electronics industry; cold bright gold process; a new bright gold process containing indium and antimony; and heavy gold alloy plating in Europe.

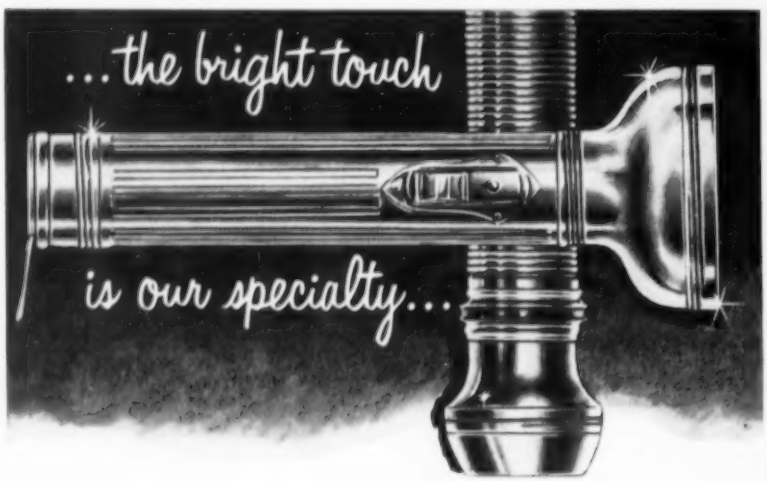
H. Denis Hughes, Dalic Metachemical Ltd. of Canada, described "Dalic Finishing Processes." He also used slides to illustrate many points throughout his talk.

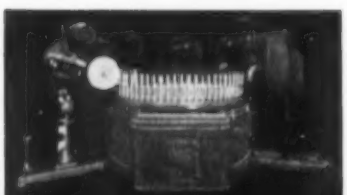
"Recent Developments in Gold Alloy Plating" was the subject chosen by Edward A. Parker of Technic, Inc. He stated that recent developments in gold alloy plating have been due entirely to the growing ramifications of the electronics field. Gold antimony alloys are used in the transistor field while the connector field is using gold nickel alloys for anti-galling surfaces. To eliminate delamination by standard gold plating procedures, the printed circuit field is using gold silver alloys which permit plating at room temperature and very low free cyanide. All of these alloys contain 95 per cent or more of gold.

While the men were in educational session, the ladies were guests of the Branch at a matinee performance of "New Girl in Town," a musical based on Eugene O'Neill's play "Anna Christie," playing Boston just prior to its New York opening. Mrs. Hilton M. Smith Jr. was in charge of the ladies entertainment.

In addition to the President, the National Society was represented by First Vice President Francis T. Eddy, accompanied by Mrs. Eddy, and John P. Nichols, executive secretary.

The banquet was held in the hotel ballroom. Double rows of gaily decorated tables lined both sides of the large dance floor which was crowded with dancers between courses and after the evening's entertainment. In one of the four acts, several Boston Branch men added to the hilarity of one of the acts by their good-natured participation.





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SPEAKERS AT THE BOSTON ANNUAL—(Left to right) E. C. Rinker, Sel-Rex Precious Metals; Dr. Edward A. Parker, Technic, Inc.; Dr. Samuel Heiman, AES national president; H. Denis Hughes, Dalic Metachemical; and F. Wayne Martin, Technical Session chairman.

Distribution of the many door prizes was professionally handled by Louis V. Gagnon, Branch past president. Hubert H. Foley was the general chairman of the successful annual affair.

BRIDGEPORT

Eddy Discusses National Organization

The regularly scheduled business meeting and educational meeting of Bridgeport Branch, was held in the main ballroom of the Hotel Barnum on Friday, Feb. 8, 1957.

Vice president **Floyd Tatum** called the meeting to order with 33 members and guests present.

One application for membership was received.

Officers nominated were: President, **Floyd Tatum**; 1st vice president, **Michael Tamas**; 2nd vice president, **Allen Ferguson**; librarian, **W. Lindsay**; secretary-treasurer, **R. Parker**; Sergeant-at-arms, **A. Jocis**; **W. Lindsay**; Board of Managers, **G. Eckholm, R. Goral, R. Barrett, C. Temple, H. Maskowski.**

Emil Bergen reported that all details for Olde Timer's Nite had been finalized.

A letter from **Dr. Heiman** asked Bridgeport to appoint a representative to serve on a national committee to investigate a proposed change in the structure of the society. President **Bonazzo** appointed **W. Lindsay.**

Lucky **Tony Chenis** once again was receiver of the door prize.

Frank Eddy, national vice president, discussed the workings of the society and the activities of the Interim Meeting. As it was an open discussion, many controversial points were discussed. Mr. Eddy enlightened us as to the problems involved in the proper administration of the national organization.

Refreshments were served and the viewing of the current Friday nite fight was enjoyed by those who stayed.

Bob Parker

BRIDGEPORT

Newell Speaks on Stress in Electrodeposition

The regularly scheduled business meeting and educational session of Bridgeport

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Branch was held Friday, March 8, 1957. President **Bonazzo** called the meeting to order. Thirty-five members and guests were present.

Three new members were accepted.

Further nominations of officers, in addition to those previously nominated, were: Librarian, **William Hyatt;** Sergeant-at-arms—**Joseph Hass;** Board of Managers—**William Lindsay** and **George Haas.**

A verbal report was given by the secretary concerning the recent action of the national Executive Board in rescinding any refunds to the Branch as a result of suspensions, resignations or deaths. Action on this revocation was tabled until the actual letter was presented.

Joe Lucas said that any member who may be interested in studying metallurgical engineering should contact him. The Bridgeport Engineering Institute contemplates the formation of a course of study in this field provided enough interest is shown.

Carl Schaefer won the door prize.

I. L. Newell, president of the Henry Souther Engineering Co. was the featured speaker of the evening. His topic "Role of Stress in Electrodeposition of Metals" was excellently presented. Samples of nickel plated parts showing the lack of and the effect of stress were displayed.

Bob Parker

BRITISH COLUMBIA

Tour Steel Plant

On April 26, the British Columbia Branch met at the Vancouver Steel Co.

The secretary mentioned regional meetings with Seattle and Portland. As sufficient interest was shown, this will be pursued and presented to a future meeting. The idea would be to have a fall regional meeting.

Neil Holman, librarian, gave details of an AES-British Columbia Branch sponsored night school course this fall. Eight of those present showed interest and **Bill Marquardt,** president, felt publication in the night school calendar would easily meet the minimum of 15 needed.

Bill Marquardt introduced **Charlie Heap** who was to be the guide. He distributed plant tour sheets and explained layout of the bolt and rolling plants. After this preliminary briefing, the party was divided into six groups of five members each with a guide which were shown over the entire rolling mill and bolt plants. After the tour, questions were answered by Mr. Heap and he gave a short resume of the future plans of the company.

CHICAGO

Big Game Hunter Crawford Shows own Movies

The April meeting of the Chicago Branch of the American Electroplaters' Society has traditionally become known as Ladies Night. The meeting was held at Algauer's Fireside Restaurant. One of the highlights of the evening was the beautiful new spring hats worn by the ladies. Following the delicious dinner, **Clyde Kelly**, past president of the AES, and of the Chicago Branch as well, installed the new officers elected at the last meeting.

The entertainment for the evening was the presentation of colored movies of hunting mountain lions in Arizona. **Carmi Crawford,** president of Chrome-Rite Inc., has for many years been an avid sportsman. He has taken big game trophies of practically every description. This was, in fact, the color-movie-diary, presented by the man who did both the picture taking and the hunting. The pictures were very exciting, the photography was excellent, and Mr. Crawford proved to be a very interesting narrator.

J. C. Corre
Publicity Chairman

CINCINNATI

Committees and Representatives Appointed

The meeting was called to order by President **Loveless** with 47 members and guests present.

Three applications for membership were approved.

Roger Winterman reported on the Tri-State Meeting at French Lick. It was decided that there would not be an annual meeting in 1958 and that the 1959 meeting would be in Louisville and 1960 in Cincinnati.

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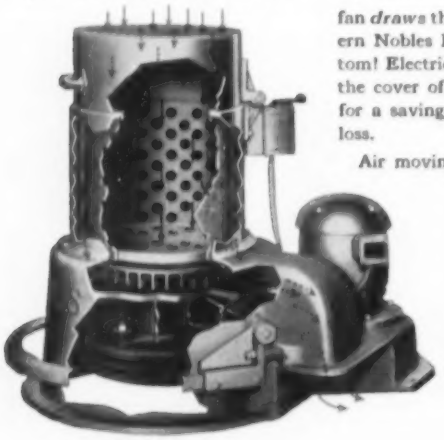

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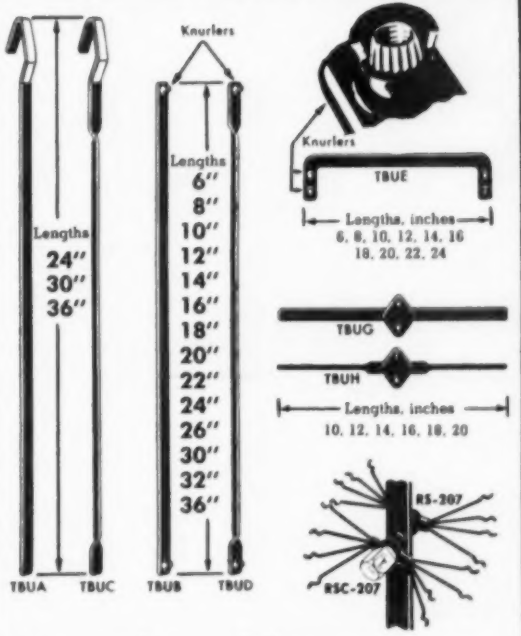

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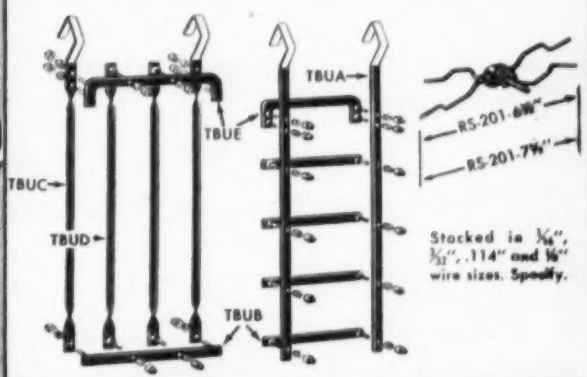

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Roger Winterman and **Earl Leonhardt** reporting for the picnic committee said that the picnic will be held at Kolping's Grove on Saturday, June 8. There would be Bar-B-Q sandwiches served from 2 until 4, the annual ball game between the platers and suppliers at 4:30 and a charcoal broiled T-bone steak dinner for all at 6:30.

The president appointed the following committees and representatives: Membership Committee, **Lester Helmich**, chairman; **Stewart Chipman, Leroy Alfrey, Charles Koneeny, Ken Edstrom.** Educational Committee, **William Stephenson**, chairman; **Don Gusse, Ed Roof.** Technical and scientific societies council representatives, **Bob Rarick** (4 years), Will Loveless (2 years). Tri-State representative, **Lee Howald** (2 years), Roger **Winterman** (1 year).

A motion was passed sending our Delegates and Alternates to the National Convention uninstructed.

It was decided to have an attendance award at each technical meeting next year. The award to be given will be decided by the membership committee.

The speaker for the evening was **Dr. Barnett F. Dodge** of Yale University. The timely subject of "Waste Treatment" was discussed with emphasis on cyanide wastes. Dr. Dodge reviewed the many methods of treatment which have been tried and those which are now in use. He pointed out the advantages and disadvantages of the various processes. The speech was completed with slides on a project which was carried through the design, pilot plant and final operation stages.

After a question and answer period, the meeting was adjourned to the social hour sponsored by the Pennsalt Chemicals Co., **Bill Wilson** acting as host.

David L. Kaplan
Secretary

COLUMBUS

Chrome Plating Subject of Bride Paper

The regular monthly meeting of the Columbus Branch was held at Battelle Memorial Institute on Friday, April 5, 1957.

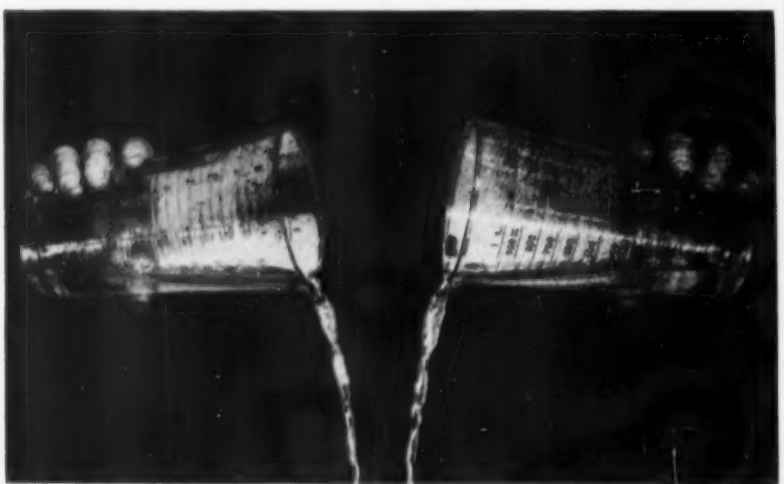
Following a film entitled "High Tides in Newfoundland" the business meeting was called to order by President **Bill Shriver.**

Tri-State committee member **Doug Gordon** told of the successful meeting at French Lick, Ind., on March 30. The 1958 Tri-State meeting was postponed to 1959 when it will be held at Louisville, Ky. This was done because of the national convention being held in Cincinnati in 1958.

The nominating committee consisting of **Bill Neill, Walter Denney and Nat Koslin** presented a slate of candidates for branch offices for 1956-57 and they will be voted on by mail before the **May** dinner meeting.

Librarian **George Skelly** introduced the the speaker of the evening, **Ed Bride** of Diamond Alkali, whose subject was "Chrome Plating Up-to-Date." Mr. Bride gave an interesting talk on the background of chrome plating and traced it through to its present state of knowledge where catalysts are used instead of the conventional sulfate radical in an increasing number of chrome baths.

Halvor S. Christianson
Secretary



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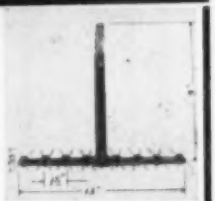

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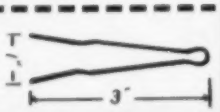

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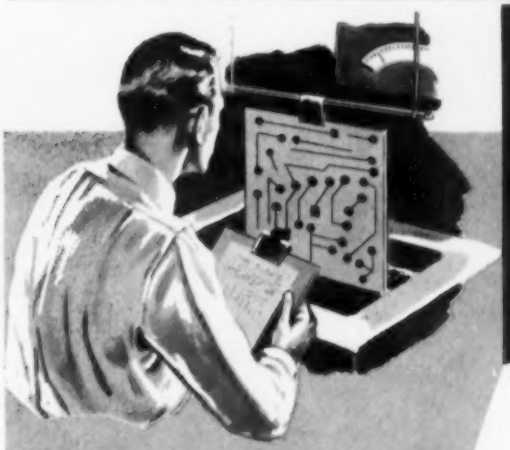

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DAYTON

Mitchell Talks on Chromate Coatings

The Dayton Branch held its regular April meeting at the Dayton Biltmore with with 35 members and guests present. Six new members were elected since the February meeting.

The speaker for the evening was **Harold Mitchell,** technical director of the Chemical Corp., Springfield, Mass., and his topic was "Chromate Conversion Coatings". Extreme interest was shown in this topic as evidenced by the lengthy question and answer period following the talk. Numerous samples were shown as well as an excellent color movie showing processing of these coatings.

Refreshments after the meeting were through the courtesy of Mr. Mitchell and his company.

R. M. Clinchens
Secretary

HARTFORD

New Officers Installed

The regular Branch meeting was held on April 15 at the Bond Hotel and 59 members were present including guests. Preceding the meeting the new officers were presented for the coming year by **Ralph McCahan.** Installed were: President; **Walter Acker;** First Vice President, **Arnold Johnson;** Second Vice President, **Armand Faucher;** Secretary, **Stanley Platoz;** Treasurer, **Bernard Cohen;** educational advisor, **Eugene Dowling.** Educational Committee, **Richard Mullaney,** chairman; **Walter Dyber** and **Edward Crandall.** Board of Managers; **Arthur Logozzo, Ralph McCahan, George Colombie** and **Stanley Grabowski.**

The guest speaker for the evening was **Jack Winters** of Incar Inc., whose subject was "The Anodes' Side of the Story." Mr. Winters very interestingly discussed the importance of the anode in plating and stated the same amount of care should be given them as the work at the cathode. Anode rods and hooks must be kept clean, polarization and bipolarity were explained. Anodes in still, barrel and automatic plating, as well as baths of zinc, copper, nickel, cadmium and chrome were discussed. Burning of parts and use of dummies to keep zinc from going into solution were explained.

The technical chairman for the evening was Richard Mullaney.

Stanley Platoz
Secretary

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LOS ANGELES

Heiman, Meyer, Missel Address Annual Meeting

Record-breaking attendance was established at the 27th Annual Educational Session and Dinner-Dance program which was held under the auspices of the Los Angeles Branch on March 23 at the Ambassador Hotel in Los Angeles.

Members and guests from the jurisdictional area of the Los Angeles Branch, augmented by a substantial representation from the San Francisco Branch, turned out to the number of 200 for the daytime technical sessions and 650 for the dinner-dance function in the evening.

Branch committees, headed by General Chairman **Harvey K. Hunt,** and Education Chairman **Emmett H. Babcock,** arranged for an uninterrupted technical program for the hours between 9:00 a.m. and 12:30 p.m.

We were honored by the presence of our National President, **Dr. Samuel Heiman,** who addressed the morning session on "Some Practical Plating Problems." He chose for the purpose of his talk a number of shop problems that had come to his attention during the past few months, and concerned comparatively new developments. Equally as interesting as his off-the-cuff discussion of shop problems and his answers to questions from the floor, was the series of slides on tank design, solution composition and anode-cathode arrangement for specific plating aims.

Dr. Heiman preceded his technical talk with a report on AES activities. He offered a detailed account of the functioning of the headquarters' office staff in Newark, N.J. He deplored the absence of Los Angeles members on the roll of national officers and committees, and urged that, as the fifth largest branch in the national society, Los Angeles should take action in getting their branch represented on the national level of the Supreme Society.

Dr. Walter R. Meyer, president of Enthone, Inc., of New Haven, Conn., gave a presentation titled, "Some Plating

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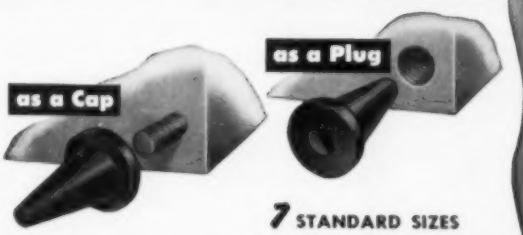

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Officers of the AES Los Angeles Branch for 1957–1958 term. (Left to right) Ed W. Wells, Board of Managers; E. H. Babcock, Secretary; L. Truman Stoner, Board of Managers; Earl Coffin, Installation Officer; Earl W. Arnold, Board of Managers; George Magurean, President; Norman K. McEwan, First Vice President; Frank Virgil, Librarian, Harvey K. Hunt, Treasurer; Milton Weiner, Sergeant-at-Arms. Not present for the picture, Kenneth C. Johnson, Research Committee Chairman.

Solutions in Action." This was undoubtedly one of the best technical programs ever presented before the branch in the 27 years it has been sponsoring annual educational sessions. A "standing room only" audience was given an intimate glimpse of what happens inside the plating tank during plating operations. The audience was able to view through projected transparent plating tanks on a screen what occurs when inhibitors and wetting agents are added to a plating solution, the action of the anode and cathode, the color changes that occur, and how various cyanide and acid baths react when electrolysis is applied.

Both Dr. Heiman and Dr. Meyer obligingly submitted to a half-hour's question and answer period which followed their talks.

The final speaker for the day was **Leo Missel**, manufacturing research engineer of Lockheed Aircraft Co., Missile System Division, Burbank, Calif., whose paper was titled "Electrodeposition of Titanium Alloys."

Following the successful technical presentations, President **Truman Stoner** called the luncheon to order. He introduced the local officers, visitors and guests of honor. **Larry O'Neil** presided as toastmaster sponsoring both the door prizes and story-telling contest. A total of 22 stories were presented by various members and prizes were issued to the three best story tellers.

The evening dinner-dance was held in the Embassy Room of the same hotel. The ladies received gifts upon entering. The dance floor was in great demand during the evening. A waltz contest was held, and awards given. Three hundred door prizes, which were donated by local manufacturers, job shops and supply

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houses, were distributed intermittently during the affair to the lucky winners. The enjoyment of all was most gratifying to the people who had worked so hard toward the success of the affair.

Credit must be given to the following committeemen and local officers: L. Truman, Branch president, chairman ex-officio; **Harvey K. Hunt**, general chairman; **Emmett H. Babock**, educational chairman; **Harold P. Wanamaker, Lawrence O'Neil, Dexter Halldin,** reservations committee; **Lawrence M. Henderson, George A. Peters,** luncheon and registration; **Fred A. Herr, Kenneth C. Johnson, G. Stuart Krentel**, publicity and printing; **Glen J. Beckwith, Kenneth Baum, L. Truman Stoner,** door prizes; **Phil Simon,** entertainment; **William Thomas,** favors.

Frank Virgil
Branch Secretary (Ex Officio)

LOS ANGELES

Barson and Weiner Win Membership Contest

The regular monthly meeting of the Los Angeles Branch was held on Wednesday, April 10 at the Rodger Young Auditorium. In addition to the technical session, the outgoing officers of the Branch were dismissed from their duties with high commendation and the newly elected officers installed.

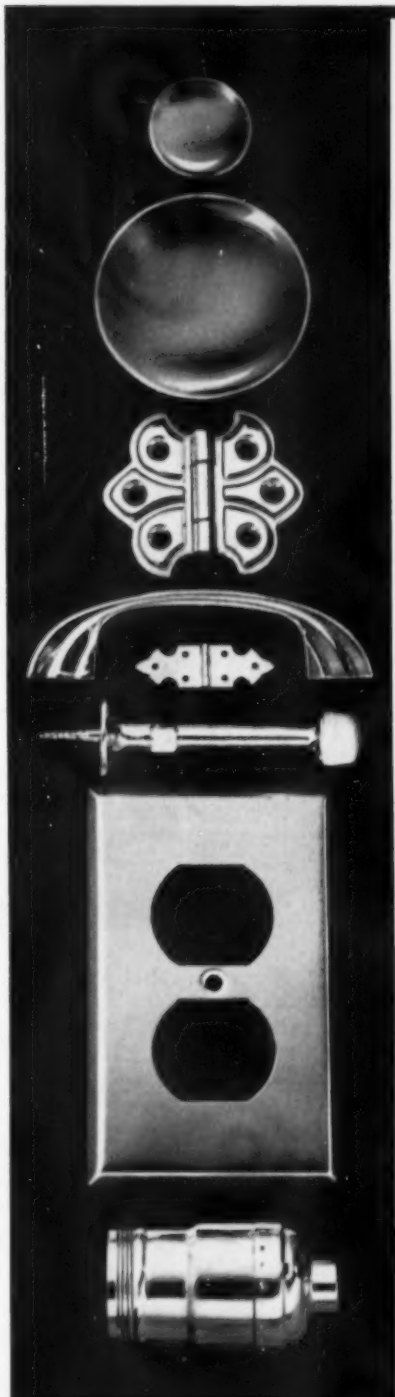
Following the usual social period and dinner, President **Truman Stoner** called the meeting to order. There were 81 members and guests present. **Larry Henderson,** sergeant-at-arms, introduced the 11 guests, among whom was **Bob Norton,** member of the Newark Branch and sales manager for Hanson-Van Winkle-Munning.

First Vice President **George Magurean** then introduced two prospective members for consideration, and two new members were introduced and installed by President Stoner.

Earl Arnold gave a report for the Board of Managers on the special executive meeting which was presided over by AES President Heiman, on April 23. This meeting was very informative for all of us. We wish that similar ones could be held more often.

Harvey Hunt, general chairman of the annual Technical Session and Dinner Dance, gave his final report before the membership and discharged his various committeemen and committees with a commendation for a job well done.

President Stoner put before the membership the proposition of subscription to a sustaining membership by the Los Angeles Branch. **Dr. P. J. Rich,** member at large, strongly supported the proposition as did several other members. It was moved, seconded and approved that the Los Angeles Branch subscribe to a sustaining membership for the 1957–58 session.



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It was felt by all that it was a very worth while expenditure of Branch funds.

The meeting was then turned over to First Vice President George Magurean, chairman of the membership committee, who reported on the results of the membership drive for the past year and presented the awards to the winning members. During the past season, 50 new members were installed and 8 members transferred into the Los Angeles Branch from other Branches. The prize winners in the membership contest were: **Marty Barsoom,** first prize, $25 war bond; **Milton Weiner,** second prize, $10 gift certificate.

President Stoner than commended the other current officers for their efforts on behalf of the Branch during the current year and dismissed the various appointive chairmen and their committees with the exception of the general chairman for the 1960 Convention, **Tony Stabile,** who will remain in office continuously until the close of the national convention in 1960. He then turned the meeting over to our perennial installation officer, **Earl Coffin,** who presided ably over the retiring ceremonies for the outgoing officers and the installation of the incoming officers for the 1957–58 term.

Incoming President George Magurean gave a short acceptance speech and then appointed **Milton Weiner** as sergeant-at-arms and re-appointed **K. C. Johnson** as research committee chairman. Mr. Stoner announced that at the request of D. N. Eldred's widow, the Branch sent a donation to the Heart Fund in place of flowers.

Librarian **Frank Virgil** introduced **Phil Kerrigan,** field engineer for Behr Manning who gave a short introductory talk and then presented the color sound film "Use of Abrasive Belts for Metal Polishing." This film demonstrated a number of applications for the use of abrasive belts over flexible wheels, formed and unformed so that they would conform to the shape of the article being polished.

Emmett H. Babcock
Secretary

LOUISVILLE

New Officers Elected; Houston President

The regular monthly meeting of the Louisville Branch, American Electroplaters Society was held Thursday, March 21, 1957 at Hasenour's Dining and Cocktail Lounge with a dinner served at 6:30 PM. President K. C. Reifsteck opened the meeting with 30 members and guests present.

One application for membership was reported.

A. A. Oertel, chairman of the nominating committee, announced the names of candidates for office during the 1957–1958 fiscal year. The group was unanimously voted into office as follows: President, **J. S. Houston;** First Vice President,

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The BRIGHT LUSTRALITE #10 bath has excellent throwing power.

Plate of uniform thickness can be deposited on parts with complex shapes.

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Control of bath is similar to the control of bright-copper plating baths.

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W. P. Radcliff; second vice president, **J. R. Smith**; secretary-treasurer, **R. G. Marshall**; librarian, **K. C. Reifsteck**; sergeant-at-arms, **Harold Peters**; Board of Managers, **K. C. Reifsteck, John Scholl, A. A. Oertel.**

Jack Houston was nominated and voted to represent the Louisville Branch as junior member of the Tri-State Regional Committee.

President **K. C. Reifsteck** introduced the speaker of the evening, **Bruce Young** of Detrex Chemical Industries, Inc. who spoke on "Modern Metal Cleaning Procedures with Emphasis on the Ultrasonic Process." Mr. Young gave a resume of the development of cleaning materials bringing us up to date with the use of ultrasonics. An excellent demonstration in which buffing compound was removed from brass and zinc castings while immersed in a vapor degreaser utilizing sonics, proved the value of this cleaning medium. The talk was supplemented by slides.

R. G. Marshall
Acting Secretary-Treasurer

MELBOURNE

Automation Topic of Guest Speaker

The meeting on March 21, 1957 was opened by President **Howard.** Forty-one members and visitors were present.

One new member was elected.

P. Major was elected secretary.

All business was then suspended to enable the guest speaker, **M. Brodribb,** to give his lecture on "Automation," after which the meeting was thrown open for general discussion.

After a long and lively discussion, **Mr. Christian** proposed a vote of thanks to the speaker, and congratulated him on an enjoyable and informative lecture.

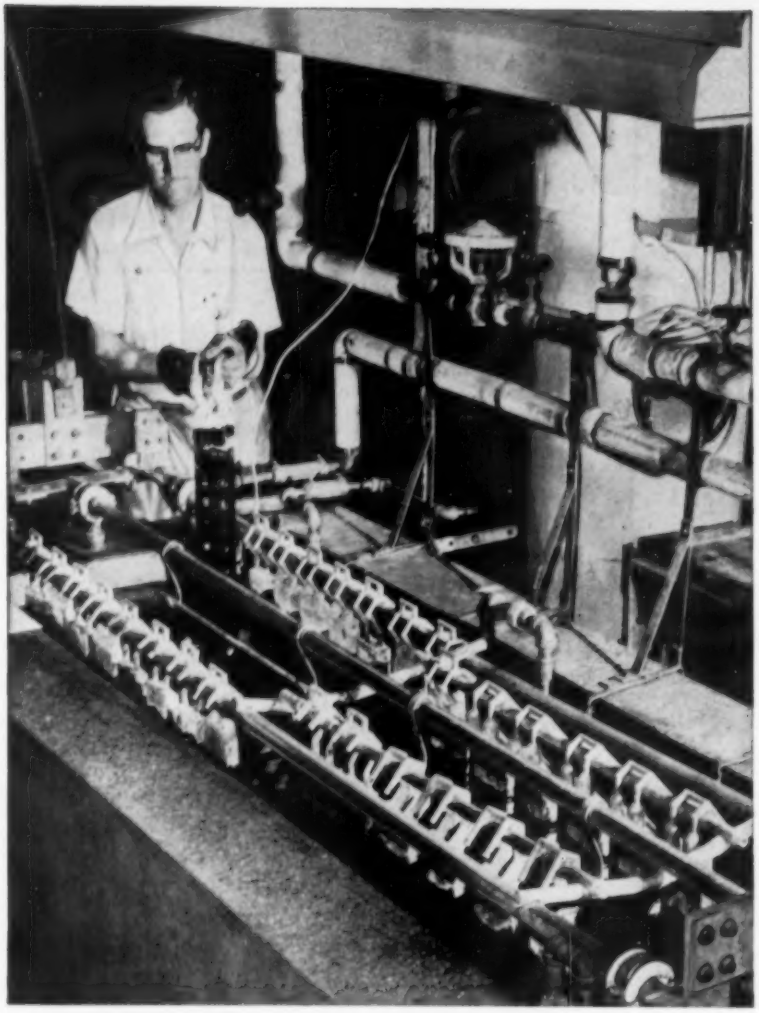
MILWAUKEE

Hold Unguided Conference

The 478th regular meeting of the Milwaukee Branch was held April 5, 1957. Four men were elected to membership in the branch. It had been announced by **E. H. McCoy,** chairman of the membership committee, that 42 new members had been elected to membership since September 1956. This record was a tribute to the collective efforts and vitality of the Milwaukee Branch membership.

June 5 was confirmed as the date of the Annual Pabst Blue Ribbon Dinner Meeting. This is the last regular meeting of the year and is traditionally popular with the membership. The meeting will be a non-technical one with **Walter Pinner** as the guest.

Delegates and Alternates to the National Convention were elected. Delegates are: **H. Tessman, P. Ritzenthaler** and **L. Diveley.** Alternates: **H. Bornitzke, R. Steurnagle** and **F. Marshall.**



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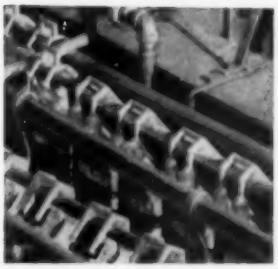

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The educational session for the evening was a joint one with members of the organic and inorganic divisions sharing the same speaker. The paper "Preparation For Metal Finishing" was presented by **G. A. Lux,** technical education director of Oakite Products Inc.

In his paper, Mr. Lux discussed the factors to be considered in the selection of a cleaning process and outlined the advantages and disadvantages of the various cleaning procedures. The factors involved in the selection of a cleaning process were such things as the surface to be cleaned, the nature and quantity of soil, optimum cleanliness desired, methods available, cost, safety, disposal and water supply. In addition, Mr. Lux developed the factors involved in the satisfactory performance of various cleaning methods such as burnoff, blasting, solvent wiping, degreaser, emulsion, diphase cleaning, alkaline and acidic. The factors judged most important in the operation of a cleaner were concentration, temperature, agitation, age, time of immersion and rinsability. He gave many practical suggestions helpful in the daily operations involving metal cleaning for both the plater and organic finisher.

Following the talk by Mr. Lux, an unguided conference was held on the subject of How To Choose An Alkaline Cleaning Material. Conferees were the following members of the Milwaukee Branch who represented total experience of 200 years: **J. Wright, V. Mattacotti, T. Hartshorn, E. Garchime, W. Higgs, R. Tardiff, S. Bivins, R. Steurnagel, K. Olson, H. Bornitzke, H. Tessman.** The conference evolved 13 points to consider in choosing an alkaline cleaner.

S. Taterzynski
Secretary-Treasurer

MISSISSIPPI VALLEY

Bulat Presents Paper on Ultrasonics

The April meeting of the Mississippi Valley Branch was held at the Moline Legion Hall on April 17. The meeting was called to order by **Barney Nordblom** second vice president. Twenty-six persons were present.

Stanley Baker introduced **Dr. T. J. Bulat,** director of Ultrasonics Application Laboratory of the Pioneer Central Division of Bendix Aviation Corp., speaker of the evening. His subject was "The Application of Ultrasonics To Plating." Dr. Bulat defined ultrasonics as sound waves, the frequency of which are beyond the audible range of the human ear. In his talk, he pointed out that an ultrasonic unit consists of two components, a generator and a transducer. The transducer may be either piezoelectric or magnetostrictive. If a high frequency current is passed through certain crystals, such as quartz or barium titanate the crystal will

expand and contract at the frequency of the current. If the crystal is submerged in a nonelectrolyte such as trichlorethylene, the motion is transmitted to the liquid. This is the principle of the piezoelectric transducer. The magnetostrictive transducer works on the principle of alternate contraction and expansion of magnetic materials when a high frequency current is passed through a wire winding around the metal. The principle of transmission of the motion to a liquid is similar to that used in the piezoelectric transducer. In addition to the high frequency current applied to transducers, a DC current is also superimposed.

Ultrasonics find applications in both gaseous and liquid media. Defective mazda bulbs are made to explode when passed into an ultrasonic field passed through air. An exact replica may be made on metal from another utilizing ultrasonics. Ultrasonics are used in liquids in degassing, in cleaning and in certain plating applications. The largest application is cleaning prior to some subsequent treatment such as plating.

A movie produced by the American Galvanizers Association entitled "Must It Rust" was shown. Also, a color movie produced by the Denver & Rio Grande RR entitled "Journey to Yesterday."

Paul G. Chamberlain
Secretary-Treasurer

NEW HAVEN

Roberti New President

At the April 9 meeting of the New Haven Branch, **C. Kuster,** chairman of the Educational Committee, reported that **Frank Eddy,** first vice president, would be at the May meeting to answer questions on the National Society. A letter containing some very good ideas on promotion of better attendance was read and will be discussed at the next business meeting.

The recent questionnaire that has been printed will be sent to all members for their answers before a conclusion can be reached on the meeting night, type of meeting, etc.

William Lindsay reported on a special committee that was appointed at the Interim Meeting in Pittsburgh to study the possibility of forming regional areas where each Branch's delegate would meet and discuss the agenda, etc. for National Conventions. These meetings would be held before the conventions and the local Branches would be able to instruct their delegates. A New England regional meeting has been set for May 2, at the Statler in Hartford, Conn.

The officers elected at the meeting are: President, **Leo Roberti;** vice president, **Charles Kuster;** librarian, **Fred Allen;** assistant librarian, **George O'Connor;** secretary-treasurer, **Bernard Gaffney;** sergeant-at-arms, **Harry Taylor;** historian, **Edward Foley;** board of managers, **Austin P. Jackson, Wm. K. Murray, Edward Busby;** delegates, Wm. Murray, **Henry Kellner, George Hottel;** alternates, Austin P. Jackson, Harry Taylor, George O'Connor.

The gavel was turned over to the new president who then presented **Austin Jackson** with the past president's pin.

George O'Connor, technical chairman, introduced the speaker of the evening, **Dr. Richard B. Saltonstall,** technical director, of the Udylite Corporation. His subject was "Electroplating of Nickel with Emphasis on the High Speed Chloride Bath."

The door prize was donated by **Al Ferguson** of MacDermid Inc.

B. Gaffney
Secretary-Treasurer

NEW YORK

Saltonstall Speaks on Electrochemistry

The March 22 meeting was called to order by **D. Hartshorn Jr.**

Two applications for membership were received.

Librarian Joe Rembecki presented **Dr. R. B. Saltonstall,** technical director of

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. . . the name of our new composite abrasive for hard buffing compounds used on non-ferrous metals . . . in laboratory tests and actual use TAMART has proven equal or superior to similar abrasives now in use . . . and of special interest to you, TAMART is far more economical.
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The Udylite Corp., whose topic was "Electrochemistry of Electroplating." Using Dr. Glasstone's "Fundamentals of Electrochemistry and Electrodeposition" as a guide, Dr. Saltonstall attempted to give to the practical plater some explanation of the phenomena of depositing metals from an aqueous solution. With the aid of slides, he touched on the composition of an atom. He discussed ionization of water, acids and bases. He also discussed *p*H, the electromotive series and hydrogen overvoltage, which he explained is a form of polarization. Unfortunately, time did not permit the speaker to get beyond the elementary stage of the electrochemistry involved in electroplating.

Anthony P. Briganti
Recording Secretary

PHILADELPHIA

Four Speakers Heard at Sustaining Members Meeting

The regular meeting was held on April 22 at the Engineers' Club. Because it was Easter Monday, attendance was only 30 at dinner with but 35 at the meeting. Guests were introduced, minutes were read, the treasurer's report was heard and two applications were received. The secretary announced the Boston Annual on May 4. It being Sustaining Members Night, First Vice President **Cogan** read the names of these members in the Philadelphia area and introduced their representatives present.

Librarian **Irvin Hauseman** introduced **Dr. J. O'M. Bockris,** University of Penna., project director of AES Research Project No. 16, "Mechanism of Electrodeposition." Dr. Bockris spoke about the theoretical approaches being made on solving the problem posed by the project—what takes place at the interface of the solution and metal. He touched briefly on the experimental methods being tried. Extremely pure and replaceable crystals and solutions must be used.

Following Dr. Bockris, **E. R. Bowerman,** committee chairman of Project No. 16, spoke on behalf of the Research Committee. He said that none of us actually know what happens in the plating reaction. He felt that the project at the University of Penna. will give us real insight into this. Singled out for special mention was the work being done by the project on ultra pure solutions.

The principal speaker was **Dr. Frederick A. Lowenheim,** Metal and Thermit Corp., whose subject was the performance of tin alloy electrodeposits. His talk was limited to the corrosion of tin-copper (bronze), tin-zinc and tin-nickel alloys in marine, industrial and marine-industrial atmospheres as determined by specially prepared panels. Slides illustrated the results obtained. Noteworthy was the improved corrosion resistance imparted by applying the alloy deposits over a very thin copper flash on steel panels as compared to the results obtained by the deposit applied directly to the steel surface.

AES President **Dr. Samuel Heiman** spoke on his recent trip to the West Coast Branches. He reported on the Branch, National Society, technical and industrial aspects of his trip.

I. Wm. Marcovitch
Secretary

PITTSBURGH

Ladies' Night

The annual Ladies' Night Banquet of the Pittsburgh Branch AES was held at the Gateway Plaza in Pittsburgh's Golden Triangle April 27. A fine gathering of 300 persons made the affair one of the most successful in recent years.

Co-chairmen of the event were **R. M. Burford** of Pennsalt and **F. W. Mountain** of Hanson-Van Winkle-Munning. After cocktails, a filet mignon dinner was enjoyed by all.

Leo Schmitt, toastmaster for the evening, introduced the 1956–57 president **Myron Ceresa** and presented him the Past Presidents' Pin. Mr. Ceresa then

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President Myron Ceresa, left, presenting Honorary Membership scroll to Frank R. Keller.

called forth **Frank R. Keller** and presented him with his Honorary Membership Scroll.

Mr. Keller was elected to Honorary membership at the October meeting of the Branch. At present, Mr. Keller is administrative assistant to the president of the Standard Steel Spring Division of the Rockwell Spring and Axle Company. He has been with the company since 1935 and has always been active in the field of metal finishing. From 1937–1943, Mr. Keller was secretary-treasurer of the Branch and was president in 1946 during which time the national convention was in Pittsburgh. He is still a very active and willing worker of the Branch.

The new president, **I. H. Schram** was introduced by Leo Schmitt. Then the remaining officers for 1957–1958 were introduced. The drawings for the door prizes preceded the dancing to the orchestra of Lee Kelton which rounded out the evening.

Fred Stevens

PORTLAND

Shepardson Heads New Officers

Our regular meeting was held on January 22 at the Ione Plaza. The following officers who were elected for the coming year: President, **Oral Shepardson**; first vice president, **Royce Case**; second vice president, **Gordon Nelson**; secretary-treasurer, **Dale Tweed**.

Outgoing president **Darrell Anderson**, turned the gavel over to our new president, after which we welcomed into the organization a new member.

The president introduced the speaker for the evening, **Chet Kellogg**, chemist for the Rodda Paint Co. in Portland. We had a good, lively round-table discussion on the problems of paint application to metal surfaces. From the interest shown in this discussion, it was apparent that platers are still looking for the ideal paints and lacquers.

Dale Tweed
Secretary-Treasurer

PROVIDENCE-ATTLEBORO

Korbelak and Harris Speak; Officers Elected

The Providence-Attleboro Branch held their regular monthly meeting, Monday, April 15, 1957, at the Providence Engineering Society Building.

President **S. Kershaw** opened the meeting. Two new members were introduced.

Gerald Noonan, chairman of the Nominating Committee, presented the slate of officers for the coming year. The following were nominated and elected: **Sibley Kershaw**, president; **H. Leslie Ferguson**, first vice president; **Arthur W. Wood**, second vice president; **Fred L. Sherman**, secretary; **Daniel O. Turner**, treasurer; **C. L. Capobianco**, librarian, Board of Managers, **Gerald Noonan, James Potter, Dr. Edward Parker.**

John Henry, chairman of the Spring Frolic Committee, announced that the party will be held at the Portugese-American Hall, Attleboro, Mass., May 20, 1957.

President Kershaw introduced **A. L. Korbelak**, of the Sel-Rex Corporation,

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who gave an interesting talk on the problems related to "Proposed Trade Practice Rule 20," regarding the marking of gold plated articles.

A resolution was passed to write to the Federal Trade Commission urging a more equitable rule for the marking of gold electroplated articles.

John Cahill, librarian, introduced **J. C. Harris,** assistant director of research of Monsanto Chemical Co. whose subject was "Tests for Determination of Metal Cleanliness." Mr. Harris made the point that to clean a surface you must apply force in some manner, but the many tests available have a wide range of reliability. The radio active tracer tests have proved to be the most sensitive.

F. L. Sherman
Secretary

ROCHESTER

Early Planning for 1958 Regional

The April meeting of the Rochester Branch was held at the 40/8 American Legion Club and called to order by President **Fred Thiem.**

Two new members were elected. The Regional Meeting to be held in Rochester during 1958 was discussed.

Librarian **Lorin Correll** introduced the speaker of the evening, **Perry Burnham,** conveyor sales engineer for Hanson-Van Winkle-Munning Co. Mr. Burnham presented the basic principles of plating room engineering covering barrel and rack designs, tank ventilation, tank heating, air agitation, refrigeration and plating tank construction.

Linwood P. Morrison
Secretary-Treasurer

ST. LOUIS

New Officers Elected

The regular monthly meeting of the St. Louis Branch was held at the York hotel April 10 with 27 members and guests present. Two new members were accepted.

Ed Sertl reported for the educational committee. He said he had received at least ten inquiries about whether another platers course would be offered next year. Time not permitting a discussion, the school committee will meet before the next Branch meeting and have recommendations ready.

Dick Nyquist reported for the banquet committee—only about ten tables left for the annual spring banquet.

The slate of officers elected comprises: **Craig McAlister,** president; **William George,** first vice president; **William Piel,** second vice president; **Ward Kelly,** secretary; **Louis Berra,** treasurer; **Ruel Shumway,** librarian; **Robert DeGuire,** sergeant-at-arms; **Edward Sertl,** publicity agent; Board of Managers—**Robert Coulson, George Koderhandt, Andy Julius.**

The following Delegates to the National convention were elected:
Craig McAlister, Robert Coulson, Andy Julius—Alternates—Louis Berra, **Charles McGinley,** Albert Barth.

The meeting was turned over to our librarian, Ed Sertl who introduced **Allan Burman,** vice president of Cro-Plate who gave an interesting talk on "Wet Blasting As a Finishing Process."

SOUTHEASTERN

Gables on Chromate Coatings

The Southeastern Branch had **Roy Gables** in April, who presented his lecture on "Chromate Coatings for Metals." **Fred Fulforth** was conferred a Southeastern Branch Honorary Membership and then appointed a delegate. Two new members were announced. Plans were made for the Third Annual Technical Session to be held at the Dinkler-Ansley Hotel, Atlanta, the second Friday and Saturday of February 1958. New Officers were installed:

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REPORT NO. 2 / ON LOWERING TODAY'S COST OF PRODUCTION

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Controlling foam, lengthening solution life

Despite careful racking and well-planned production, deep recesses and places of normally low current density on intricately shaped parts are always trouble spots.

Diversey electrocleaners were specially fortified with exceptionally high wetting and emulsifying powers to do an effective job at those "problem places." This chemical cleaning supplements high current carrying capacities to give more efficient cleaning in a shorter time. Work emerges waterbreak-free and smut-free, ready for subsequent baths.

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DIVERSEY. ELECTROCLEANING

President, **Charles I. Lewis**; first vice president, **Claude J. Nalley**; second vice president, **Bob M. Taylor**; librarian, **Wilmont D. Tidd**; secretary-treasurer, **Robert H. Probert. George Taylor** was given outstanding recognition for his loyal and exceptionally efficient service as president of the 1956–57 year.

Robert H. Probert
Secretary-Treasurer

SEATTLE-PUGET SOUND
Dr. Heiman Honored Guest and Speaker

The March meeting of the Seattle-Puget Sound Branch was held on Friday, March 29, 1957, at the College Club in Seattle.

Reading of the minutes and discussion of old business was dispensed with in the interest of time, and the first new business of the evening was the election of officers for the coming year. The slate of officers suggested by the Nominating Committee was accepted as presented. The following members were elected to serve as officers for the coming year: **Lloyd P. Sharts,** president; **Paul H. Grimm,** vice president; **William P. Foley,** secretary; **Rodney A. Becker,** treasurer. Newly-elected to the Board of Managers were **Robert I. Carlson,** past president, and **Forster Bradford.**

We were honored to have as guest and speaker of the evening our National President, **Dr. Samuel Heiman.** Dr. Heiman opened his talk with an informative discussion of National Society affairs, using color slides of the Society's staff and facilities. Dr. Heiman then drew upon his long experience in presenting a talk on the tricks and troubles of job-shop plating, in which he offered a comprehensive series of trouble-shooting reports covering almost every phase of metal finishing.

William P. Foley
Secretary

SOUTHERN TIER
May Alternate Meetings; Open Discussion Fruitful

The regular monthly meeting of the Southern Tier Branch was held Feb. 19, 1957, at the Forest House in Athens, Pa. This was our initial meeting in Athens and it was suggested that our branch consider alternating meetings between this point and our regular meeting place in Oswego, N. Y., to better accommodate members from the Binghamton and Elmira areas.

The dinner and meeting was attended by approximately twenty members and their guests.

After the dinner, President **C. Bound** opened the meeting and considerable emphasis was given to attending and supporting the Regional meeting in Syracuse in April.

After a short business meeting, our librarian, **M. Rake,** moderated an open discussion period of metal cleaning and finishing problems which were current with those present at the meeting. It was felt that type of discussion is very helpful to the platers and that they can carry much beneficial information back to their respective plants.

B. Rossiter
Secretary

SOUTHERN TIER
Will Hold Meetings Throughout Summer

Regular monthly meeting of the Southern Tier Branch was held Mar. 19, 1957 at the Au-wa-ga Hotel, Owego, N. Y. The meeting was opened by vice president **S. Stephanski.** It was suggested by **M. Rake** that the society attempt regular monthly meetings during the summer period. After a short discussion, **Mr. Fletcher** made a motion which was accepted that the society carry on their regular monthly meetings during the summer months.

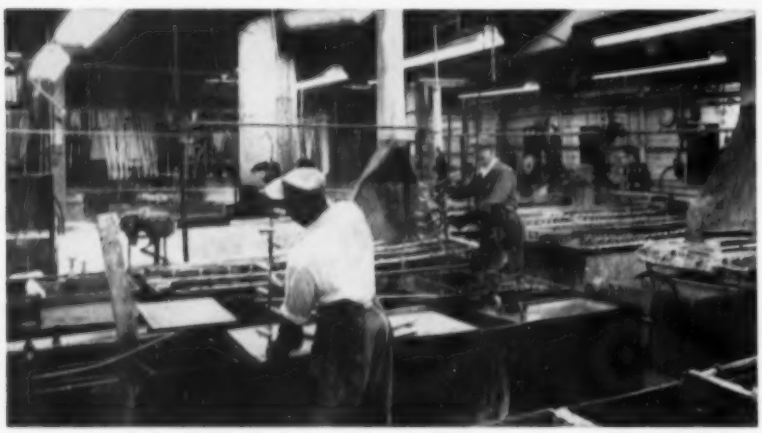
Mr. Stephanski introduced **Joe Branciaroli,** technical representative of the Diamond Alkali Co. as speaker of the evening. His topic was "Chrome Plating Additive No. 1800 versus Conventional Chrome Plating Baths."

Advantages of this new bath are as follows: 1) Plate higher current density without burning of parts. 2) Plate heavier deposits and retaining brightness. 3) Harder plate. 4) Better corrosion resistance, fatigue strength, and higher iron tolerance.

Disadvantage: 1) May etch bare steel, where part is not plated.

B. Rossiter
Secretary

BUSY CLEVELAND JOB PLATER.....



AT this large plating shop, Cowles cleaners (QC, FE, KW, WM, AA and NS) are being used with great success to speed up and improve cleaning operations before plating in these tanks. It has been the experience of this shop (Metal Finishers, Inc.) that one or another of these Cowles cleaners takes care of every job that comes along. And to quote Mr. Ridenour of Metal Finishers, "That's proof of Cowles' reliability, because we get those tough plating and cleaning jobs that many companies won't handle." — For specific information on cleaners for your shop, write Cowles Chemical Company, 7018 Euclid Ave., Cleveland 3, Ohio.

SOUTHERN TIER

Stephanski Heads New Slate of Officers

Regular monthly meeting of the Southern Tier branch was held April 16, 1957, at the Forest House in Athens, Pa.

The meeting was presided over by President **C. Bound.**

Elected to office for 1957–58 are: **S. Stephanski,** president; **M. Rake,** vice president; **W. Rossiter,** secretary; **W. Wood,** treasurer; **C. Emery,** librarian.

Those serving as the new Board of Managers are: C. Bound, **L. Rood, G. Zurenda, C. Harris, C. Cordier.**

Austin Fletcher made a motion, unanimously passed, that the outgoing president be accepted as chairman of the Board of Managers.

A visiting member, **Ed Elliott** of the Syracuse Branch, was present and spoke on the proposed program and meeting at Syracuse of the N. Y. State Regional, April 27. It was noted that several members from this branch plan to attend.

W. Rossiter
Secretary

SPRINGFIELD

McCahan Has Tough Subject

The Springfield Branch met at Blake's Restaurant on Monday, April 22, for the regular monthly meeting. After a steak dinner, the members present settled back to listen to what **Ralph McCahan** of DuPont had to say on "Copper Plating Before Carburizing."

His opening statement proved a true one. He said Springfield sure had picked a tough subject for him to discuss, as not too much was known about this subject generally throughout the trade. It seems each individual job, shop and material had its own special requirements, for individual results.

He dug into his past experiences and store of knowledge and came up with some general facts and a table to follow as a guide.

It is expected that the 18th New England Regional Meeting will be a huge success, as every ticket is gone, and there are calls for more.

Henry L. Heissfeld
Secretary

TORONTO

Visit Canadian Hanson and Van Winkle Plant

The April Meeting of Toronto Branch was held at the Etobicoke plant of the Canadian Hanson and Van Winkle Co. Light refreshments and dinner was provided by our host, Mr. **Griggs.**

Mr. **Davis** of the Udylite Co. was introduced. The speaker was **Ed Turner** of C. H. V. W. Windsor, who spoke on full automatic machines for the plating industry. **John Smith** presided at the meeting.

Ted Blandy extended thanks on behalf of the Toronto Branch to **Mr. Whalen** of C. H. V. W. for their kind hospitality, and a very enjoyable evening.

A. W. Wilson
Librarian

WATERBURY

Eddy Installs New Officers

The Waterbury Branch held their monthly meeting in the Colonial Room of the Roger Smith-Elton Hotel, Thursday, April 11. **Theodore Voyda,** past president, opened the meeting and discussed some of the highlights of the past year.

Installed by **Frank Eddy,** first vice president of the national AES, were **Spencer Henn,** president; **Edward Garland,** first vice president; **Frank Tirendi,** second vice president; **Albert Griffith,** secretary treasurer; **Isadore Cross,** librarian; **Louis Porretti,** assistant librarian, and **Nicholas Topazio,** publicity director.

The meeting was turned over to Frank Tirendi who acted as moderator of a panel discussion on metal finishing, in which the following took part: Mr. **Voyda,** Apothecaries' Hall Co.; **William Innis,** MacDermid, Inc.; **Perry Sloane,** Harper-Leader Co.; **Frank Schneiders,** Enthone, Inc., and **Harry Streeter,** Oakville division, Scovill Mfg. Co.

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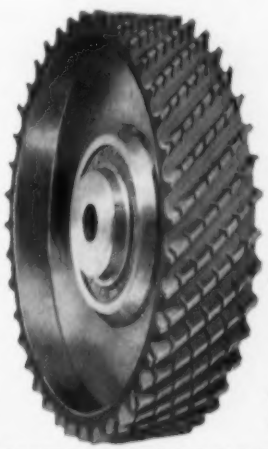

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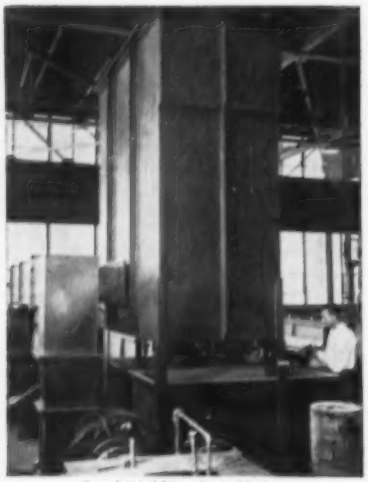

Steel Pickling Installation

KNIGHT Fume Washers

Knight Fume Washers are wet contact scrubbers. The working surface is BERL Saddle packing. This unique shape not only provides maximum surface area and minimum pressure drop, but also causes the repeated directional changes in the gas stream necessary for efficient scrubbing.

Each unit is designed to provide low-cost operation, minimum fan power and water consumption. Careful attention is given the liquid distribution system, since it is so important to efficient operation. Each unit is equipped with a mist eliminator section through which the washed gas is discharged.

Knight Fume Washers are fully protected against corrosion by application of Pyroflex, Sealon, or Neoprene lining to the full-welded steel shell. When required, an acid-proof brick lining is installed over the membrane. All internal parts such as the grillage, BERL Saddle packing and distributor are made of acid-proof material. Thus, the entire unit is inert to chemicals being handled.

Write for Bulletin No. 9 on Fume Washers.

Maurice A. Knight
Kelly Ave., Akron 6, Ohio

KNIGHT-WARE
CHEMICAL EQUIPMENT

Allyn D. Chabot, a loyal member of Waterbury Branch for thirteen years, died from a heart ailment on Thursday, March 28, 1957.

Harry M. Johnquest, has recently been retired from The Bristol Co. He has been a member of Waterbury Branch since the early twenties. The Branch will carry his name on the Active Roll for as long as he is actively interested in maintaining his association with AES.

The New England Regional Convention will be held Saturday, April 27 at the Hotel Statler, Hartford. This group is made up of the Waterbury, Hartford, New Haven, Bridgeport and Springfield Branches.

The next meeting will be held on May 9. A plant tour of MacDermid, Inc., is planned.

Nicholas Topazio
Publicity Director

WESTERN ONTARIO

Melekian Speaks on Plating Operation

The April Meeting was held at the Wm. Pitt Hotel in Chatham, Ontario.

Alex Corbit was presented with the Past Presidents' Pin and Officers for the new term were introduced.

Speaker for the evening was **Charles Melekian,** production engineer, Ternstedt Flint Division of General Motors Corporation, whose subject was "Plating Operations at Ternstedt, Flint Division of General Motors Corporation." The talk covered equipment, processes, problems and control and was illustrated with slides. Mr. Melekian very capably handled a lively question and answer session.

D. R. Mainland
Vice President

NEW FILMS

Two Heads Are Better Than One
(col-snd-18 m)

Shows action sequences of various models of multiple-head, conveyor-type abrasive belt grinders in production on ferrous and non-ferrous metals, plastic and other materials.

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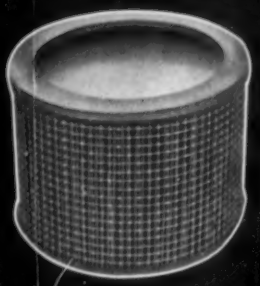
Reynolds Chemical's development of a special liquid compound gave the automotive industry this sealing gasket application for auto air filters. The Reynosol is molded, and the filter inserted and cured directly in the plastisol, to permit an integral, permanent-type filter unit.



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Opportunity to Authors

Authors of technical and scientific papers on electroplating, metal finishing and related arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING for review and publishing consideration.

Any such paper accepted and published in PLATING will also become eligible, of course, for selection by the Society's PAPER AWARDS COMMITTEE for the Carl E. Heussner Award, George B. Hogaboom Award, AES Bronze Medal Award, Robert S. Leather Award, Chromium Plating Award or the Precious Metal Plating Award.

Though the submission of any such papers by AES members or non-members will be welcomed by PLATING any time during the year, this current period is particularly recommended. So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

Several hundred members of the Masters' Electro-Plating Association attended that Association's outstanding Annual Banquet held in the Grand Ballroom of the Plaza Hotel, New York, May 11. Among many other features, Albert A. D'Agostino was named that body's "Plating Man of the Year." Above, Mr. D'Agostino with Mrs. D'Agostino and Julian Nelkin, left, last year's recipient, who presented the plaque. Frank Kaiser presented plaques to Mariano Ranno and, in absentia, to Silvio C. Taormina in recognition of their efforts in behalf of the industry in the nickel crisis.

Washing area 8" x 8" x 8"; power required 115V 60 cycles.

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The Curtiss-Wright Ultrasonic Washer WB1-5 provides an improved parts cleaning method which meets today's higher standards, closer tolerances and ultra-precision design of component parts. Now practical for all types of production parts washing, this self-contained stainless steel unit *super-cleans* all dirt and grease away in mere seconds, even the most complicated or "problem" shapes having grooves and hollow areas. Space-saving, safe to operate and low in cost, the WB1-5 can effect a saving of up to 75% over conventional parts cleaning methods. Our engineers will arrange demonstrations.

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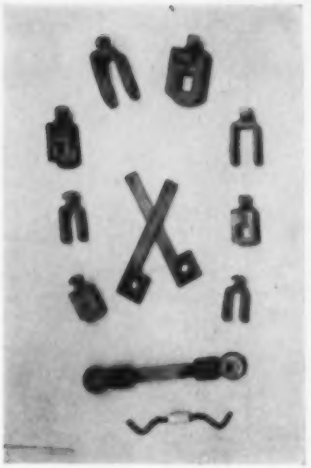

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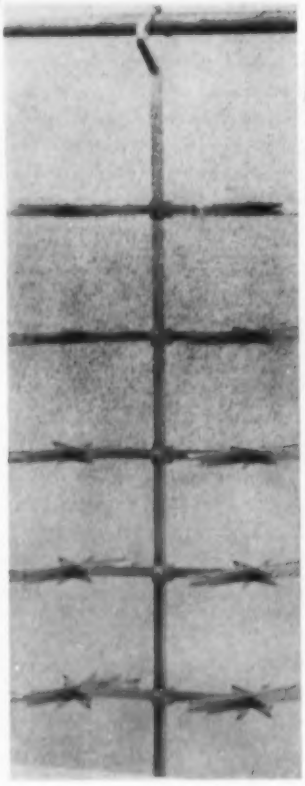

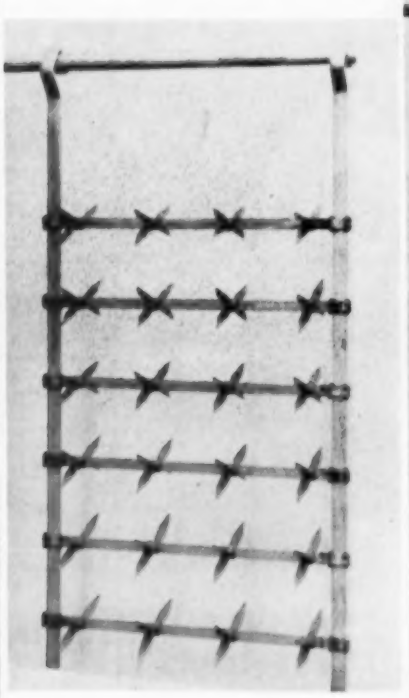

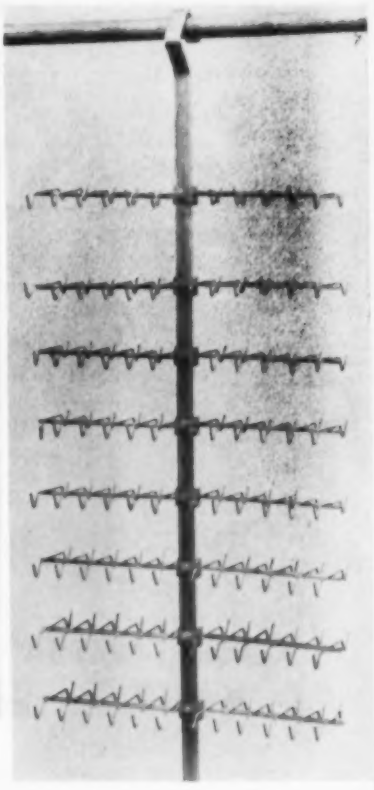

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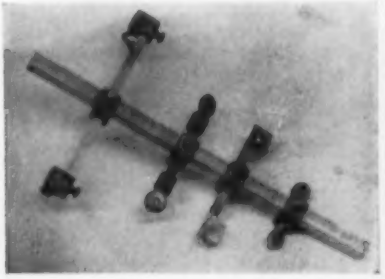

STANDARD

PLATING RACK COMPANY

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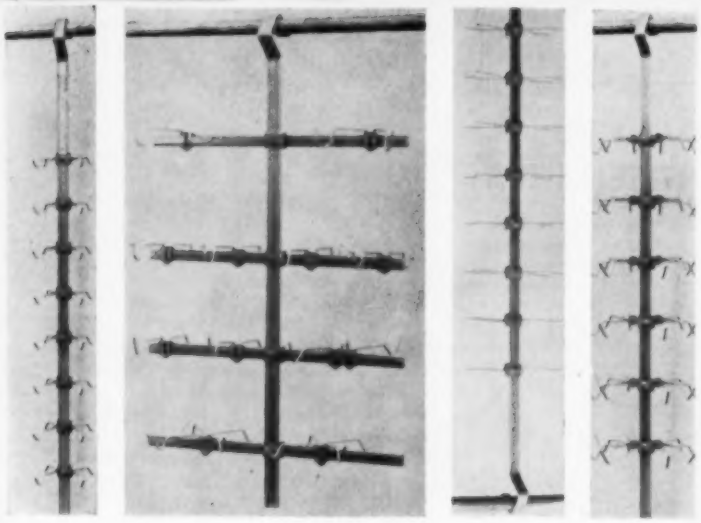

"Stand-It-All" Rack Patch does the complete patching job on your insulated plating racks. One or two coats are ample and it is air dry.
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It's a must for patching after making a tip replacement . .
Injured Areas Are Mended to Perfection With Just a Squeeze of the Tube . . .

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STANDARD'S

ERECT-A-RACK

Now you can make up your racks exactly as you need them, when you need them, at the lowest possible cost. You can cut rack preparation time to a fraction for those emergency jobs—using pre-formed parts.

No bulky equipment needed for bending and forming—you need only a wrench. Simple and fast assembly gives you almost any possible combination of rack contacts and arrangements.

You can have the necessary parts for any rack you're likely to need, right in your own stock. A full range of standard parts is available—all you do is clamp the desired contacts on a spine, slide them along to get the desired spacing, and tighten.

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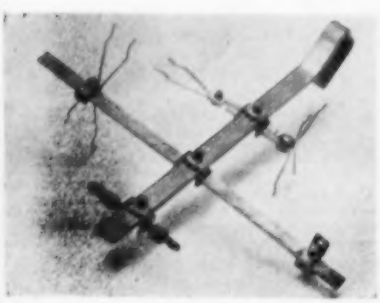

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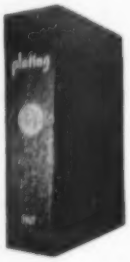

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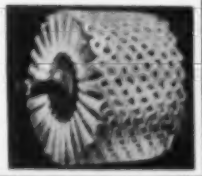

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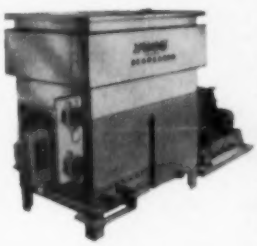

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FUTURE MEETINGS

A E S

June 16-20—44th AES Annual Convention, Sheraton-Mount Royal Hotel, Montreal, Canada

November 2—Philadelphia Branch, Annual Educational Session and Banquet, Penn Sheraton Hotel, Philadelphia, Pa.

February 14-15, 1958—Southeastern Branch, 3rd Annual Technical Session, Dinkler-Ansley Hotel, Atlanta Ga.

May 19-22, 1958—45th AES Annual Convention, Sheraton-Gibson Hotel, Cincinnati, Ohio

June 14-18, 1959—46th AES Annual Convention, Detroit, Mich.

June 10-14, 1960—47th AES Annual Convention, Hotel Statler, Los Angeles, Calif.

INTERSOCIETY

June 11-13—3rd Western Plant Maintenance Show, Civic Auditorium, San Francisco, Calif.

June 14—Society of Plastics Engineers. Regional Technical Conference, PLASTICS FOR ELECTRONICS, Lowell Institute of Technology, Lowell, Mass.

June 16-17—National Association of Metal Finishers, Annual Convention, Sheraton-Mount Royal Hotel, Montreal, Canada

June 16-21—American Society for Testing Materials, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

August 7-9—6th Annual Conference on Industrial Applications of X-Ray Analsis, Denver Research Institute, Metallurgy Division, University of Denver, Denver, Colorado.

October 6-10—Electrochemical Society, Fall Meeting, Statler Hotel, Buffalo, N. Y.

November 4-8—39th National Metal Exposition and Congress, International Amphitheatre, Chicago, Ill.

February 10-14, 1958—American Society of Testing Materials, Committee week, Statler Hotel, St. Louis, Mo.

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for Complete Branch Directory

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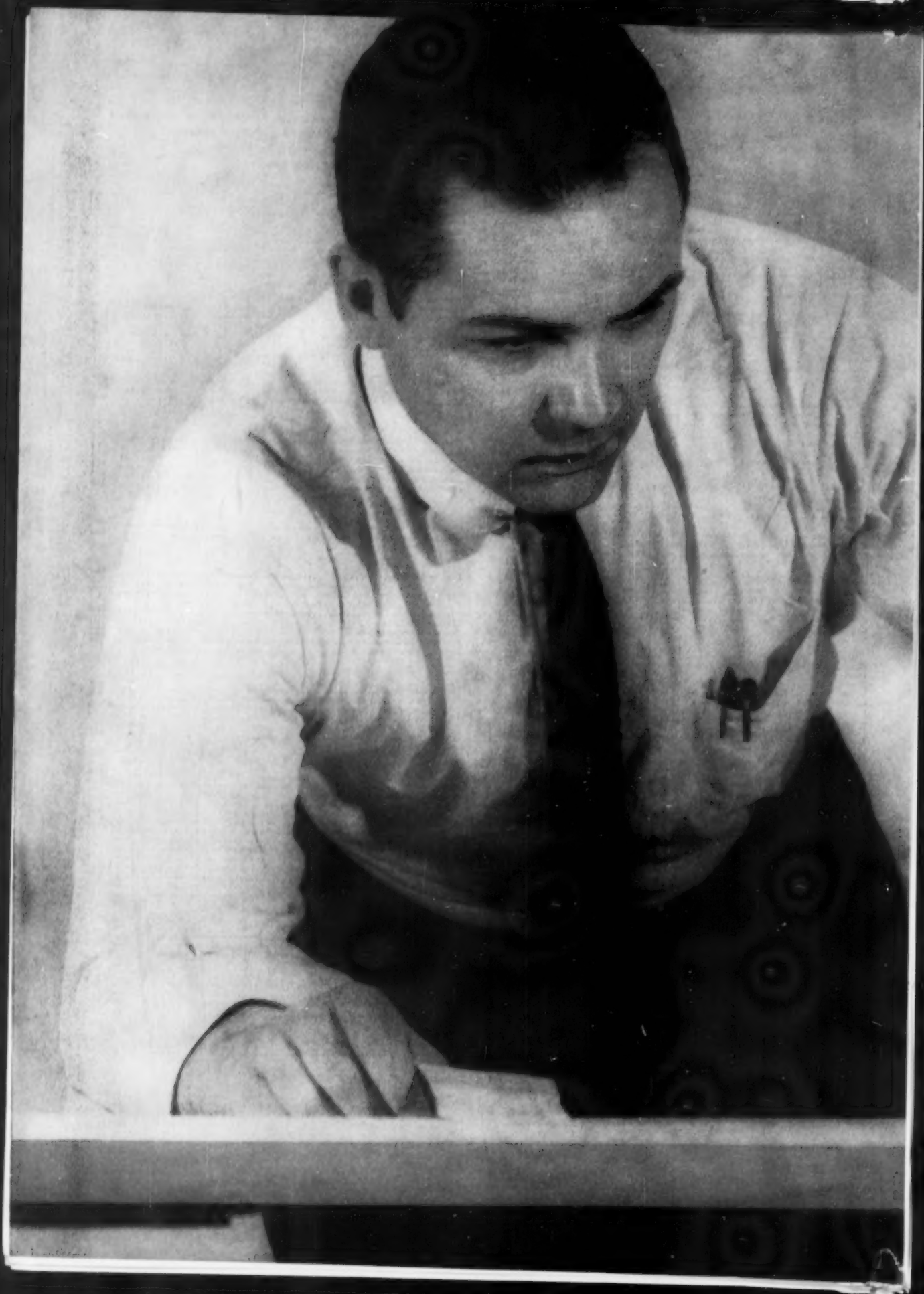

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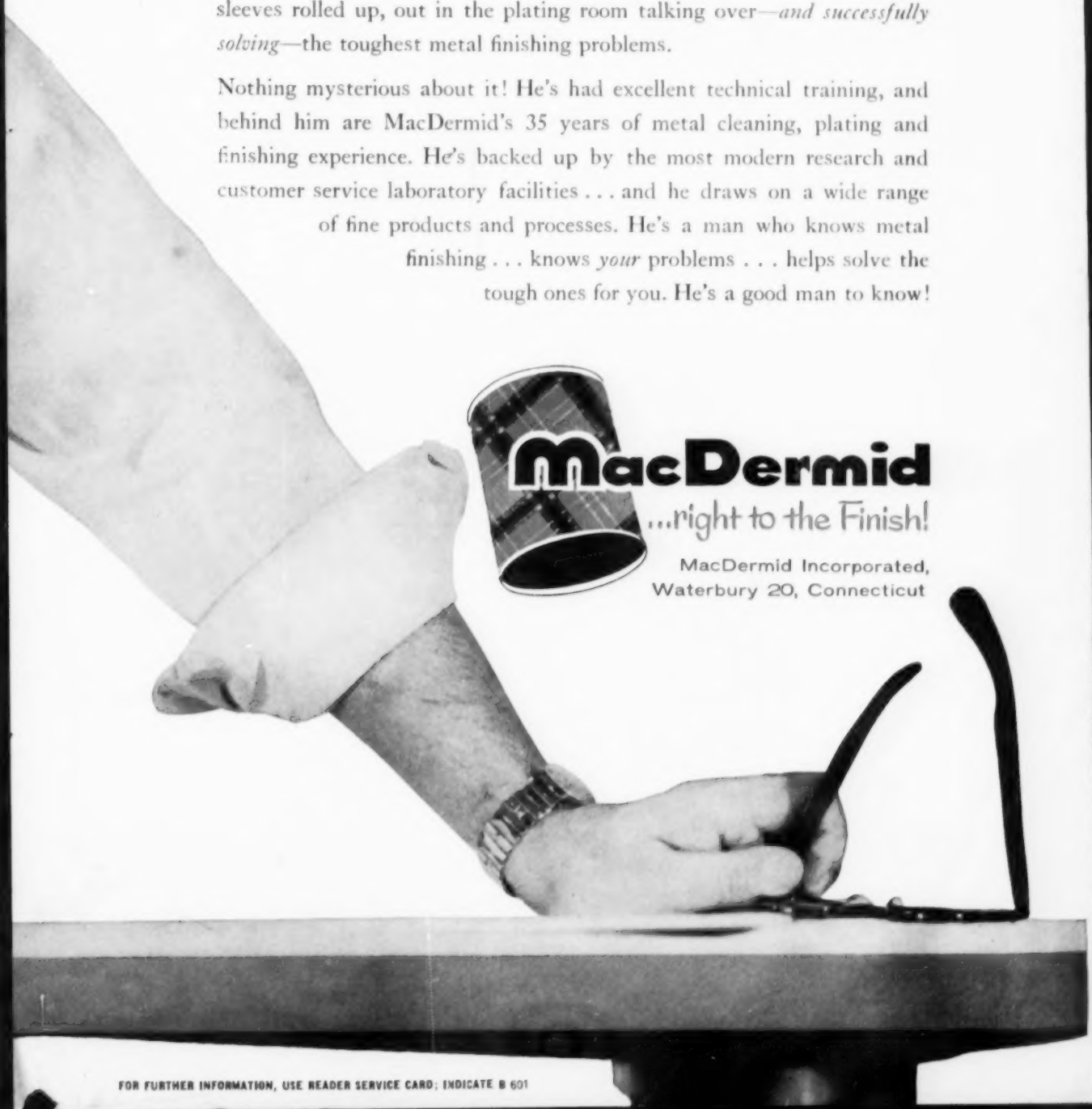

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